MEDICAL ELECTRONICS NEWS

TRADEMARK

INSTRUMENTATION, ELECTRONIC AND ELECTROMECHANICAL DEVICES FOR USE IN BIO-MEDICAL RESEARCH, DIAGNOSIS AND THERAPY; RADIOLOGY; AIR POLLUTION, ETC.

Instruments Publishing Co.
845 Ridge Ave.
Pittsburgh 12, Pa.
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Print order this month 34,000

VOLUME 1—NUMBER 1 **MARCH 1961**

The Measure of a Civilization

THE MEASURE of a civilization is how it divides its energies and spends its substance. For the past 15 years the "advanced" nations of the world have devoted most of their public expenditures to mass destruction. The effort has been successful—science and technology have enabled humanity to destroy itself. Yet in 1961, these same nations will spend an additional $100 *billion* for even more destructive power. The insanity of this situation is so glaring that it must change, soon. The major nations of the earth must divert these huge sums into other channels—or perish.

Where then, should these billions be spent?

As the great problems facing mankind are in the areas of health, education, and welfare, the bio-medical fields should be among the first to expand when society does divert its energies into constructive, rather than destructive, channels.

This publication is the first national technical trade journal to serve the infant field of bio-medical electronics. Today the commercial market for medical electronic equipment is small—in the order of $200,000,000, mostly X-ray devices, a microscopic figure compared to other areas of electronics. But it is significant that this publication—*MEDICAL ELECTRONICS NEWS*—is being published by The Instruments Publishing Company which, 34 years ago, brought out the world's first trade journal in industrial measurement and control—the magazine *INSTRUMENTS* (now known as *INSTRUMENTS & CONTROL SYSTEMS*). The market for industrial instruments thirty years ago was even smaller than the present medical electronic market—but it grew to become the multi-billion-dollar automation industry in which the publication *INSTRUMENTS & CONTROL SYSTEMS* is the acknowledged pioneer and leader. History repeats, at an accelerating pace.

Pioneering in paths of social advancement should be rewarded. This issue, the first issue of *MEDICAL ELECTRONICS NEWS*, is supported by 27 advertisers (Note: there are 3000 firms which make products with potential use in the medical field.) These firms deserve special recognition; we are proud to publish their names:

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Future issues of MEN will emphasize special aspects of medical electronics, including:

RADIOLOGY (image intensification, safety)
CARDIOLOGY (electrocardiography, resuscitation)
PULSE ANALYSIS (histograms)
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ANALYTICAL TECHNIQUES (chromatography, polarography, colorimetry, refractometry, spectroscopy)
OPTICS (ophthalmology, microscopy)

Printed immediately below this message is the name of your "sponsor," a local supplier of medical electronic apparatus. The bulk of the circulation of this publication results from the support of these local suppliers of apparatus.

Continued on page 2

A NECESSARY LINK . . .

We're glad that so many agree (see Letters to the Editor, on page two) that Medical Electronics News truly is needed and wanted, and can become a vital link between the practitioners in two important areas of activity.

Obviously, this issue's advertisers also see the merit of such communication; and we're sure others will follow their lead into the pages of Issue No. 2 scheduled for June publication.

If **you** manufacture electronic or instrumentation devices for use in the bio-medical field, then you should advertise in M-E-N.

If your equipment has application in diagnosis, surgery, therapy, radiology, or research—or in the detection and control of air pollution and other elements affecting public health —M-E-N is ideally suited to carry your ad message to those who can and will apply your equipment.

Ad space reservations are acceptable any time up to the June 1 closing date, for the June issue. Contact any of our District Managers listed on page two herein.

MEDICAL EQUIPMENT MANUFACTURERS' REPS

Some openings still exist for "rep" sponsorship of M-E-N to their customers and prospects.

For details on how this sponsorship can help you in your sales work, write to Mr. Richard Rimbach, Publisher, Medical Electronics News, 845 Ridge Ave., Pittsburgh 12, Pa.

ADV-REP

Continued from page 1

This issue, devoted to the broad realm of medical electronics, highlights the multitudinous products available and ready to help doctors, clinicians, technologists and researchers. For more data on any product reported in this issue, simply circle the appropriate number of the postage-free reader service card.

The electronics industry has experienced five major periods—the radio era, the radar era, the television era, the industrial era, the missile era. It is about to enter its sixth and most important era—the MEDICAL ERA.

MEDICAL ELECTRONICS NEWS

Instrumentation, Electronic and Electromechanical Devices for use in Bio-Medical Research; Diagnosis and Therapy; Radiology; Air Pollution, etc.

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EDITORIAL FUNCTION & SCOPE

Medical Electronics News will provide a means whereby the results and techniques of the instrumentation and electronics specialties can be made more generally available.

As part of its editorial scope, each issue will report the new instruments, new techniques, and new developments in the field of instrumentation and electronics.

FIELD SERVED

Each issue will reach over 25,000 doctors and technicians active in clinic and hospital research, medical and biological research institutes, medical schools, public health research laboratories, therapy, air pollution, etc.

This, in effect, means virtual blanket coverage of the entire medical and biological research market.

ISSUANCE AND CLOSING DATES

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Other Publications of the Instruments Publishing Co.
INSTRUMENTS & CONTROL SYSTEMS
INSTRUMENT & APPARATUS NEWS
MILITARY SYSTEMS DESIGN

A PROMISING FIELD...

Few branches of instrumentation and electronics have more promise for the application of new devices and techniques than the comparatively recently opened field of biological and medical instrumentation and electronics. The application of better diagnostic tools will do much to relieve human suffering, conquer disease and circumvent operative procedures.

It is to fill this important objective that *Medical Electronics News* is designed. Each issue of this new publication will reach more than 25,000 doctors and technicians active in clinic and hospital research, medical and biological research institutes, medical schools, public health research laboratories, therapy, air pollution, etc. Each issue will report to these men the new instruments, new methods, and new developments in the field of instrumentation and electronics.

With 25,000 circulation, *Medical Electronics News* reaches more prospective users of these devices and components than any other publication. Its tabloid size permits efficient use of space—with editorial items flanked by advertising.

Potential Market

On determining potential markets and uses, we are very fortunate because the medical profession is completely documented.

Because physicians deal with birth, life, and death, it is easy to understand why the medical profession is so thoroughly documented. We know, for example, that there are about 230,000 active doctors of all ages, including staff physicians.

Not only do we know the numbers of physicians by specialties, but we also know where each one trained, the societies to which he belongs, his type of practice, his specialties of interest, and where he can be located. If he is a member of the Society for Nuclear Medicine, we need not look further to know that he is qualified to use radioactive materials and is a prospect for instruments that measure them.

Editorial Coverage

Medical Electronics News provides its readers:

1. Complete illustrated information on new instruments, electronic devices and components, laboratory apparatus and equipment, and services, edited for quick and easy reading.

2. An easy method for quickly obtaining manufacturers' cooperation when time and buying are important.

3. A digest of current manufacturers' literature on instrumentation and electronic devices which will find application in the medical field.

4. Each issue will have a report covering the trend in some phase of instrumentation and electronics.

5. Books of interest to the workers in the medical and biological fields will be reviewed.

6. Meetings of technical groups and societies of interest to this field will be listed.

7. Abstracts of papers on instrumentation and electronic devices of interest to the field will be included.

The distribution list of *Medical Electronics News,* will tap buying influences REACHED BY NO OTHER SINGLE PUBLICATION.

If you man ufacture scientific instruments and apparatus purchased and used by individuals in biomedical laboratories of research and industry, *Medical Electronics News* offers you the largest available group of actual authenticated prospective buyers of medical and biological instruments and electronics devices.

LETTERS TO THE EDITOR

Editor, MEN:

May I take this opportunity to wish you every possible success for your new magazine *MEDICAL ELECTRONICS NEWS* which should become an important publication in the medical field since this type of magazine has been needed for a long time.

Roy B. Hoag, Chairman of the Board
Electro Medical Research Associates
Schenectady, N. Y.

Editor, MEN:

May I congratulate you once again for having the foresight to enter the new and growing field of *Medical Electronics* before most of the others in the publishing field, and being aware of the potential importance of this type of activity.

If I can aid in the success of your *MEDICAL ELECTRONICS NEWS* in any way, or supply any information, I would be most happy to do so.

Dr. C. Berkley
The Rockefeller Institute
New York City

Editor, MEN:

Thank you! I certainly look forward to receiving my first copy.

Jerry Blair, Chemist
Eastern New Mexico Medical Center
Roswell, N. M.

Editor, MEN:

I was recently overjoyed to hear the announcement of your new publication—*MEDICAL ELECTRONICS NEWS.*

Richard A. Jokinen, Engineer
General Radio Company
West Concord, Mass.

Editor, MEN:

This is a short note to say "Thank you" for sending the application for MEN. Frankly I am glad to see that someone is finally taking the view that our electronic instruments are not toys and deserve attention. I am sure that your publication will be worth the zeal to use and pass on to friends.

The list of names I have given you are all laboratory supervisors and have great interest in Clinical Chemistry and a common respect for those electronic instruments that we all depend on so often.

Thanking you for MEN.

Scott Imburgia, M. T.
(Medical Technologist)
837th TAC Hospital
Shaw AFB, S. C.

Editor, MEN:

I am very pleased that such a Journal is in the offing: there has been a great need for this type of publication for some time.

Raymond Dobson, Chief
Medical Arts Clinical Laboratories
Guymon, Okla.

Editor, MEN:

Congratulations on your starting a new publication of this nature. I will look forward to reading it.

Herbert Wells, Director
Saylesville Clinical Laboratory
Lincoln, R. I.

Editor, MEN:

Good news! Have been awaiting this.

Dr. Lester Stein
Steubenville, Ohio

Editor, MEN:

O.K. You finally came up with something right down our alley—*MEDICAL ELECTRONICS NEWS.*

Lee Cahn, President
Cahn Instrument Co.
Paramount, Calif.

Editor, MEN:

Glad to see this publication come out. Will fill a real and growing need.

W. B. Scherer, Director
Psychological Instruments Co.
Richmond, Va.

Editor, MEN:

Congratulations in getting *MEDICAL ELECTRONICS NEWS* under way. Count on our close cooperation.

Donald C. Carner, Administrator
Memorial Hospital
Long Beach, Calif.

Editor, MEN:

I am most interested in getting *MEDICAL ELECTRONICS NEWS.* It is so difficult without such help to keep up with the "state of the art." Part of the challenge of our relatively new specialty of Anesthesiology is to make available as quickly as possible the research developments for clinical patient care in the operating room, recovery room and intensive therapy work. We need information.

Raymond Ten Pas, M.D.
Rancho Los Amigos Hospital
Downey, Calif.

Editor, MEN:

This fills a great need indeed, for those of us who have not been able to keep up with many new developments.

Gertrude Schanker
Linwood Clinical Laboratory
Buffalo, N. Y.

Editor, MEN:

An excellent idea and necessary.

Dr. J. Bradfort Miller
Utica, N. Y.

MEDICAL ELECTRONICS NEWS

Computer Helps Study the Human Mind

PASADENA, CALIF.—California Institute of Technology has taken a big step toward unlocking secrets of creative thinking with the dedication of a new electronic computer system recently. Raw data derived from basic research on the human nervous system is

fed into a Burroughs 220 electronic computer programmed to prepare a mathematical model of the human mind. By the rapid simulation of brain functions on the 220, a nearly infinite number of hypotheses about human thinking can be tested.

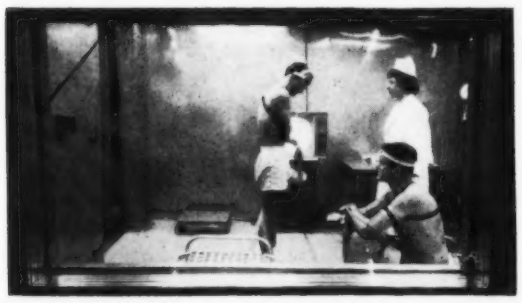
The artificial intelligence program got underway in February of last year when Caltech sponsored a four-day symposium to evaluate current knowledge on the nervous system. Thirty-five leading biologists, electronics and communications-theory experts from the United States and Europe met to discuss theories and recommend areas of future research.

The heart of Caltech's computer center is the Burroughs 220, a gift from the Burroughs Corporation.

Medical Electronics

PHILADELPHIA, PA.—The Division of Research of Lankenau Hospital, in cooperation with Brown Instruments Division of Minneapolis-Honeywell, recently demonstrated application of an automatic data handling system in environmental studies.

The hospital division, under the direction of Dr. Kaare Rodahl, is conducting research to determine the effect of varying levels of protein diet upon individual performance capacity. The subjects' diets, which may be 1500 or 3000 calories per day, contain either 70 grams of protein or none at all. In the research program, which focuses attention to acclimatization to cold, the subjects are exposed in a climatic chamber for 10 days to a constant temperature of 44°F, wear-



ing only shoes, socks, and shorts. At night they sleep on a mattress-less cot, covered only with a GI blanket.

Their temperatures are under constant automatic surveillance. Strapped to various locations on their bodies are sensitive thermocouples which feed their signals through a digital potentiometer into a Brown Analog-Digital Recorder-Transcriber. It prints out the digitized readings with resolution of 1 in 4000 by electric typewriter, or codes the results on punched cards or tape.

Other tests include recording of blood pressure and heart rates after the subject exercises on a bicycle or treadmill to near-exhaustion; use of a paramagnetic analyzer to determine maximum oxygen consumption; of an infrared analyzer to determine maximum oxygen consumption; of an infrared analyzer to measure expelled carbon dioxide; and blood-sample analysis.

UNIVERSITY OF MISSISSIPPI surgeons have successfully used 700-cps current to anesthetize a patient for an operation. Electrodes attached to the patient's temples circulated the current through the patient who remained unconscious until the current was turned off. Within a minute consciousness was regained. No ill effects or discomfort were reported, and the patient returned directly to her room without having to be taken first to the recovery room.

CIRCLE 1 ON READER-SERVICE CARD→

"Mother's Heartbeat" Simulator Soothes Infant

ELMSFORD, N. Y.—Dr. Lee Salk, consultant research psychologist at City Hospital, Elmhurst, N. Y., and brother of Dr. Jonas Salk of polio vaccine fame,

has invented a device which can mean happier babies, and thus mentally healthier adults. The unique "heartbeat simulator" reproduces the sound of a normal heartbeat. Tests have shown that when newborn infants were exposed to the sound of the mother's normal heartbeat (72 double pulses per minute), they gained weight, slept better, and cried less than babies not so exposed. The reduction of anxieties in infancy also leads to lesser chance of mental breakdown or instability in adulthood.

Sonotone Corporation, Elmford, N. Y., is manufacturing and distributing the instrument. A substantial part of the profits derived from sales will be set aside for further research in the field of mental health, for experimentations with problems of hyperactive children, and with people suffering from insomnia.

Picture shows Dr. Lee Salk (left), and Irving I. Schachtel, president of Sonotone Corporation, in a nursery at City Hospital.

FOR MORE INFORMATION CIRCLE 29 ON READER-SERVICE CARD

GULTON INDUSTRIES reports that at the recent meeting of the Instrumentation Division of the New York Section AIEE, *Dr. Walter Welkowitz*, director of Research and Development Lab, Gulton Industries, and *Dr. Russell Brancato*, head, Cardio-Vascular Lab, St. Michael's Hospital, Newark, N. J., discussed applications of medical instruments at the hospital which were developed through their cooperative efforts. These instruments, marketed by Gulton, include intracardiac blood pressure gages, microphones, external cardiac microphones, respiratory transducers, and a new recovery room monitoring system.

Gulton Industries, Inc., 212 Durham Ave., Metuchen, N. J., has twelve division in various parts of the country and subsidiaries in Canada, England and Israel.

FOR MORE INFORMATION CIRCLE 30 ON READER-SERVICE CARD

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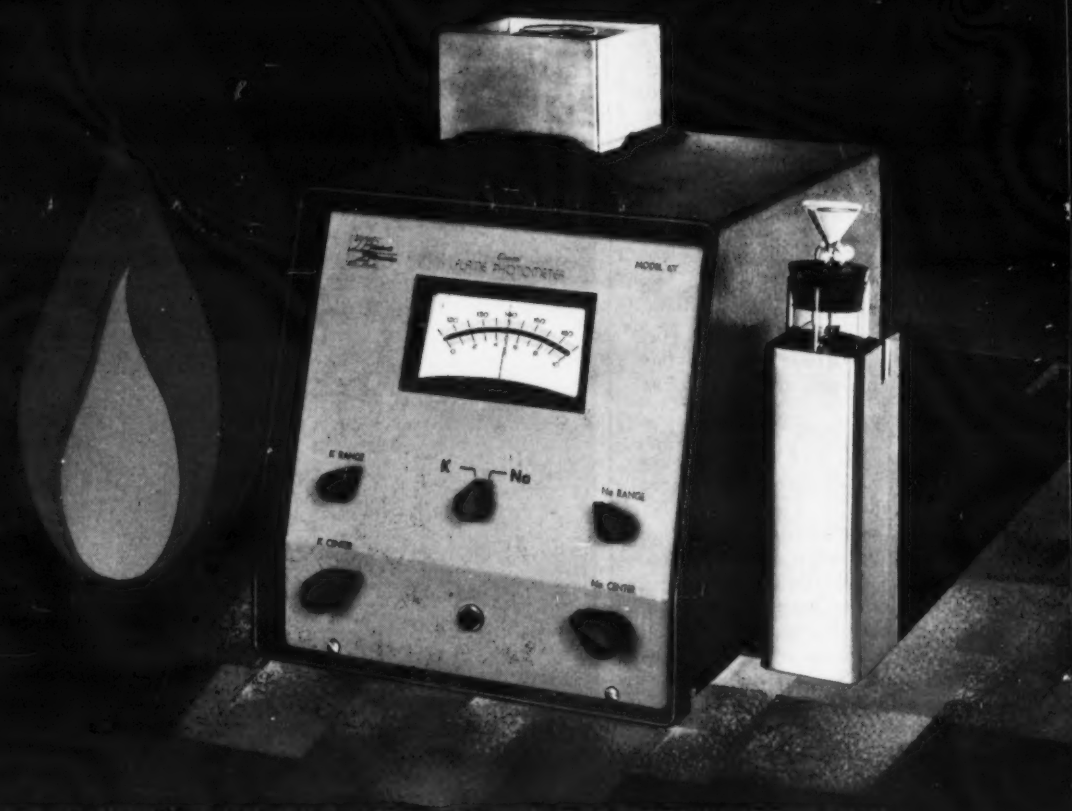

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ADVANCED OPTICS AND ELECTRONICS...SERVING SCIENCE

Simulation of Heart-Lung Systems

Simulation is a powerful technique for analyzing and synthesizing systems with inter-related variables. The Simulation Councils, Inc., is a group of men whose main interest is in simulation via analog computers. Here is a report of the Western Simulation Council Meeting of 22 July on "The Simulation of Heart-Lung Systems," written by John McLeod, editor of the Simulation Council Newsletter.

Dr. James B. Maloney (UCLA Department of Surgery, Los Angeles, California) was host to the July 22nd meeting of the Western Simulation Council held at the University of California Medical Center in Los Angeles. Subject of the meeting was "The Simulation of Heart-Lung Systems."

DeLand on Circulatory Systems

Dr. Ed DeLand (Ph.—not M.D. Rand Corporation, Santa, Monica, Calif.), the first speaker, talked about "Mathematical Models of the Circulatory and Respiratory System" or, more specifically, some work they are doing which has been reported in a U. S. Air Force Project Rand Research Memorandum.*

This project was undertaken to determine the feasibility of simulating a part of the human physiological system by a suitably constructed mathematical model.

Certainly a successful mathematical simulation of the human system or of human subsystems would provide an important tool for biological investigations. A sufficiently complex model —that is, a model embodying sufficient chemical and biological details to represent a whole, functioning human system or subsystem—could be used to explore biological hypotheses, environmental stress reactions, and interplay of dependent subsystems, and could serve as a teaching tool or even an aid to medical diagnosis.

However, the human body may be considered as perhaps the most complicated chemical factory ever devised. It is a dynamic chemical factory in which there are no absolute values.

Therefore, to date, only the techniques, concepts, and characteristics of such a mathematical model have been explored.

Ed's talk concerned a simulation of the external respiratory function. Respiration, and the resulting gas exchanges at the lung surfaces, involve many chemical reactions as well as a transformation of venous into arterial blood. So this activity was chosen for the test case.

Basing their work on the known physiological and chemical aspects of this subsystem, the investigators constructed a mathematical model which, when solved, would give values describing the major phenomena of the subsystem. Emphasis was placed on the chemistry and thermodynamics of the subsystem rather than on physical dynamics such as flow and mixing; at this stage these time-phased phenomena were expressed only implicity.

Despite these and other approximations, Ed said that the work shows that the mathematical art is now capable of representing such systems which have large and complex sets of functionally interrelated variables.

The values of some 53 different molecular species, as determined by the model, are in excellent agreement with observed values. There is therefore reason to be optimistic about the possibilities of representing other more complicated human subsystems, and interconnecting them —especially now that mathematical techniques and computing facilities are becoming available for integrating increasingly complicated sets of components. The Rand investigators feel that these techniques should be pushed to the biological or mathematical limit—whichever comes first —in the hope of constructing mathematical models for increasingly large portions of the human system.

Nevertheless, developing a complete and integrated human-system representation is quite a large order. In the first place, the size of medical libraries alone attests to the large volume of special cases which such a model would be required in some sense to interpret. We might nevertheless argue that, with luck and several years of effort by a large number of qualified specialists, it might be possible to handle the task if it were not for one outstanding fact—the great gaps in our knowledge of the human system. For instance, we know the brain plays a major role in the control of the physical processes of the body, but the exact functional relationships that define the control can at best only be hypothesized.

It is precisely in this area that the techniques of simulation provide the scientific investigator with an extremely powerful tool: a tool for testing a variety of hypotheses quickly (once the model is constructed), comparatively economically—and *safely*. Even if the results of such hypothetical explorations at first do not correspond with reality, much useful knowledge can be obtained just in attempting to determine the reasons for lack of correspondence.

*"A Mathematical Model of the Human External Respiratory System", by George B. Dantzig, James C. DeHaven, Irwin Cooper, Selmer M. Johnson, Edward C. DeLand, Herschel E. Kanter, and Crawford F. Sams (M.D., University of California); RM-2519; September 28, 1959

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CIRCLE 2 ON READER-SERVICE CARD

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And in any case the investigator's insight into the problem is markedly improved.

At RAND it was decided to simulate the external respiratory system on both analog and digital computers.

The *digital computer*, having high accuracy but requiring relatively long solution time, was used to compute the equilibrium conditions of the system and hence to test the underlying hypothesis of the model.

The *analog computer*, with lower accuracy but much shorter solution time, was used to search through a range of parameters. It can also be used eventually, it is believed, to simulate the dynamic aspects of the model. It already has proven itself a valuable tool for tracing the effects of continuously varying inputs to the system. Thus the analog can be used in complex experimental situations for estimating equilibrium constants by regarding these as parameters to be varied continuously on the machine until a good fit is found between observations and predictions.

The advantage of continuous optimization with the analog as compared to the static, one-time optimization with the digital computer is that it can thus compute and display the transient phenomena of a complex system as it changes under the influence of a time-dependent parameter.

Later on, the inputs will be outputs computed from other physiological subsystems, and the whole will be optimized according to viable criteria.

Bekey on Physiological Process

George Bekey (Space Technology Laboratories, Los Angeles, California) followed Ed DeLand's description of the work at Rand with some general comments on the challenge and problems involved in simulating various physiological processes. In this connection he described briefly some work done while he was at Beckman, using the analog computer to simulate nerve excitation.

George also mentioned that when he attended the national ASME meeting in Dallas he found that *Ben Clymer**, of the Human Simulation Subcommittee of the Midwestern Simulation Council, was very much interested in this kind of work and has prepared a rather extensive bibliography on the subject.

"We are on the threshold of a breakthrough in the application of mathematical techniques to biological problems," said George, "Because of:

1. The development of mathematical tools for the analysis of nonlinear, time-varying phenomena;

2. The development of instrumentation—micro-electrodes, miniaturized transmitters, and meters for the non-destructive measurement of flow and temperature, for instance. These give us means for verifying the model.

3. The development of methods for the study of closed-loop feedback and control systems.

*North American Aviation, Dynamics Development, Department 56, 433 East Fifth Avenue, Columbus 16, Ohio

GEORGE BEKEY: "We are on the threshold of a breakthrough in biological problems."

"Simulation of physiological systems can be divided into three general areas:

a. Simulation of human operator dynamics

b. Simulation of physiological processes (as exemplified by Ed Deland's paper)

c. Simulation of higher mental processes: neuron nets, learning machines, etc."

George mentioned some of the work being done but observed that much faster progress could be made except that "Engineers get stumped in studying biology because they run into bio-chemistry. They don't know this, so they have to go back and study organic chemistry (which they skipped in school, because it was hard)."

Nevertheless, George convinced most of us that bio-medical engineering is the coming thing, and that computer simulation of the systems involved is an extremely important—and fascinating—part thereof.

McLeod on the MAC Pump

Your Editor followed George with a description of what we hope will be a tangible contribution resulting from the cooperation of medical men and engineers: the MAC (McLeod Aerating Cardiac) Pump.

To those of you who may wonder why a Council member should be concerned with a heart-lung machine, I can only say that you must take a real broad view; rationalize that because such a machine takes over the duties of the heart and lungs it certainly simulates their function, even if not the organs themselves. Anyway, that's what those who invited me to speak said. So, after much twisting of my arm (ha!), I agreed to talk, and having talked can now write on.

Your Ed first realized the need for cooperation between medical men and engineers when he was at Harvard's Cruft Lab in 1942 and saw doctors struggling with jerry-rigged electro-encephalographs which they had to build or modify themselves. But I didn't do anything about it for 16 years, not until stimulated (literally) at a party where some doctors and engineers were discussing a heart-and-lung machine they were building. Intrigued, I asked to see it. And when I did I was impressed. The design was ingenious and the workmanship was beautiful. But something about it bothered me. Finally I realized it was its complexity.

Now your Ed likes simple things. Complexity often costs reliability, and it always costs money. "There might not be a better way to build a heart-lung machine, but there *must* be a simpler way!"

That did it! For two-and-a-half years now that "simpler" machine has been competing for all your Ed's "spare" time.

To appreciate a solution it is well to understand the problem. In this case I was given to understand that the problem was blood. More particularly, the problem stemmed from the characteristics of blood which had been especially troublesome in connection with all other heart-lung machines: it is delicate, and it foams.

The most dramatic use for a heart-lung machine—or *extra-corporeal perfusion device*, as they are more accurately known—is to take over the action of the heart and keep the body supplied with oxygenated blood during open-heart surgery when the heart itself is incapacitated. Thus the surgeon buys time to make repairs and perform apparent "miracles" which would not otherwise be possible.

Continued on page 6

medical instrumentation

All of these variables may be recorded on a Honeywell Visicorder, a direct recording oscillograph capable of obtaining up to 36 channels of information simultaneously and furnishing immediately readable traces on a moving record by means of light-beam galvanometers. These Visicorder records may be reproduced for inclusion in medical reports by several methods, and slides may be made for presentation to large audiences.

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Honeywell Electronic Medical Systems are noted for their extremely compact size, and are available in several console models. Special 4-inch diameter casters make them easy for anyone to move. All Honeywell systems incorporate versatility, ease of operation, maximum frequency response, and easy-to-read charts. Transducers, leads, and other necessary equipment are furnished, as are comprehensive operating instructions.

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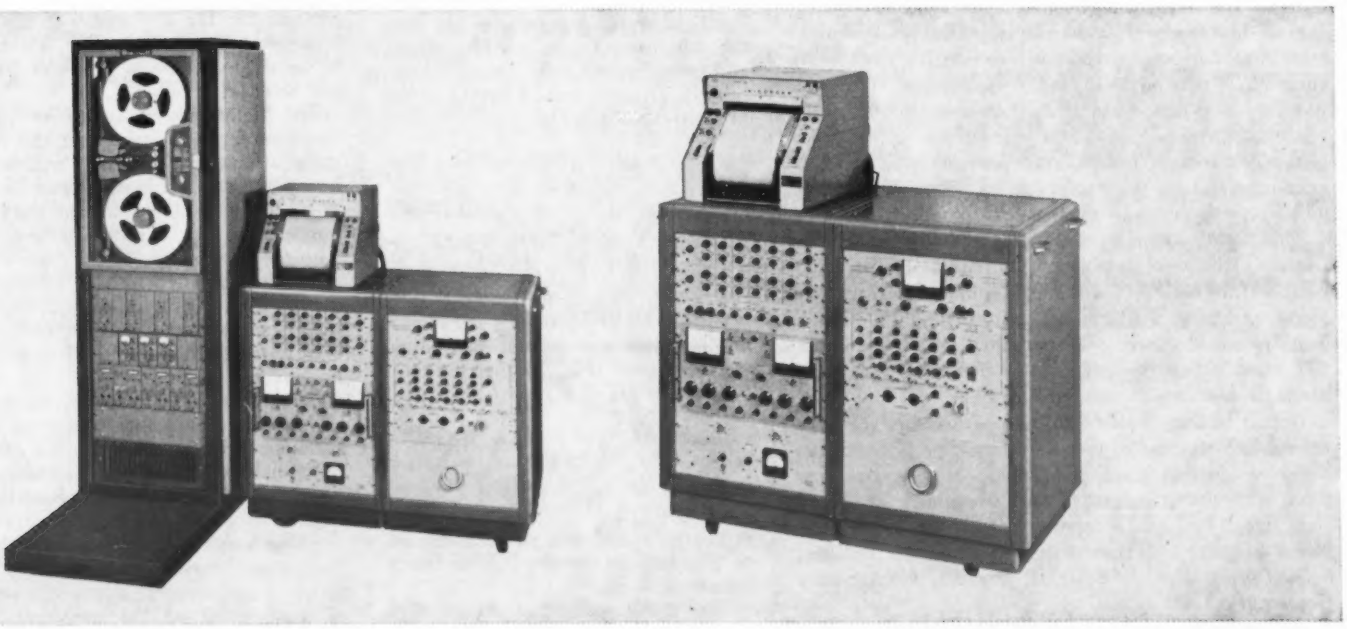

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- CONTINUOUS FLOW REFRIGERATED ELECTROPHORESIS
- CAP-O-TEST — Patented aluminum closures in 6 different colors for tube sterilization.

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Uni-Sol Concentrated Liquid Cleanser
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Several territories are still available for representatives in the scientific instrumentation field. Wide range of equipment covering biological, chemical and physical sciences.

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BRIEFS

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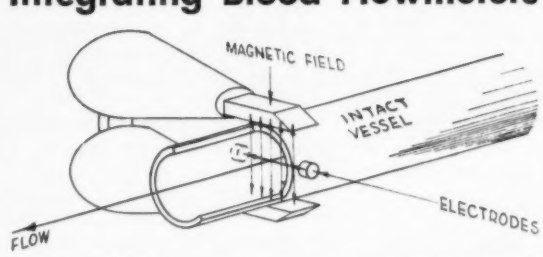
Integrating Blood Flowmeters



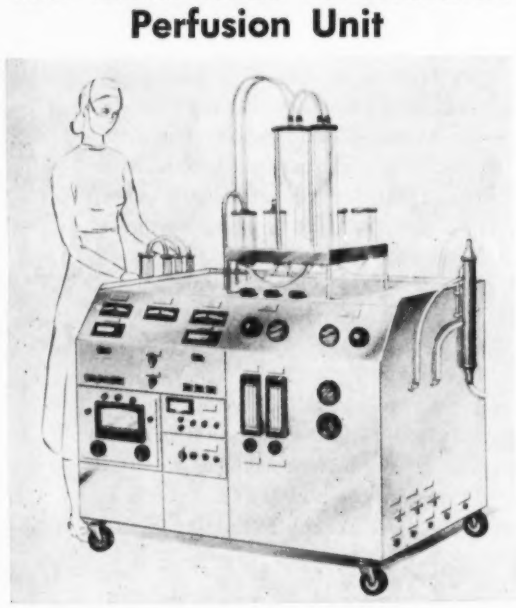
Series 5000 flowmeter systems accurately measure phasic flow, flow rate and total flow of blood in the intact vessel . . .

The principle of electromagnetic flow measurement as derived from Faraday's Law may be stated that "a voltage is generated when an electrical conductor, such as blood or saline, flow transversely through the lines of force of a magnetic field. The flow voltage generated is proportional to the magnetic flux density and the flow rate of the conductor."

The two electrodes, which sense the flow voltage and transmit it for amplification and subsequent recording are diametrically positioned at a right angle mutual to the flow axis and the lines of force of the magnetic field . . . (*From new 6-page Bulletin, Avionics Research Products Corp., 4254 Glencoe Ave., Venice, Calif.*)

FOR THIS LITERATURE CIRCLE 31 ON READER-SERVICE CARD

The Clark-Selas Intracardiac Perfusion Unit



The Clark-Selas Intracardiac Perfusion Unit is a complete, compact, integrated, fully instrumented system for the oxygenation, pumping, heating and cooling of blood under ideal physiological and clinical conditions for extra corporeal flows during open heart surgery. It can be utilized for operations within the normal blood temperature range or under moderate or profound hypothermia flow conditions . . . It is basically a "small bubble" type oxygenator, which is acknowledged by the profession as the most effective and simplest means of oxygenating blood.

The basic system consists of the following operations: (1) Oxygen humidification, (2) blood oxygenation, (3) blood de-foaming, (4) blood filtering, (5) blood pumping, (6) blood monitoring, (7) blood heating and cooling, (8) coronary blood pumping, (9) chest blood pumping, (10) coronary and chest blood de-foaming.

Details of these basic operations are instantaneously available by the use of the indicating type instruments, which set forth the following data: (1) Oxygen flow rates, (2) pump pressures and vacuums, (3) blood flow rate, (4) blood temperature, (5) blood pH, (6) blood pO_2 . . . (*From 7-page preliminary bulletin, Selas Corporation of America, Dresher, Montgomery County, Pa.*)

FOR THIS LITERATURE CIRCLE 32 ON READER-SERVICE CARD

RUSSIAN MEDICAL RESEARCH is coming up with a "universal biostimulator," a device similar to cardiostimulators which impart rythmic electric pulses to the heart. The new universal stimulator will work from tape-recorded signals (taken from healthy individuals) to stimulate not only a dysfunctioning heart, but also activity in the brain and other organs regulated by muscles.

Continued from page 5

The reason that the lung function —that of oxygenating the blood—is included is largely a matter of "plumbing." The heart and lungs are so intimately associated (the lungs being, hydraulically at least, between the two halves of the heart) that it is easier to supply an artificial lung than separate and use the natural areas.

But blood is difficult to handle without damage. It is not a liquid but a slurry, made up of small packages of hemoglobin and other components wrapped in an extremely delicate membrane and suspended in plasma. Pumps which require that valves open and close (or that passages otherwise be occluded) to pump the blood have a tendency to break the packages, destroy their function, and upset the chemistry of the system.

Blood also has a troublesome tendency to foam when it is exposed to the oxygen in the "lung" (aerating) section of the device. This also upsets the delicate balance of the system and furthermore, if any of the minute bubbles are pumped into the biological system they might cause embolism (stoppage) of some small blood vessels. In the brain this could cause damage or even death. In short, it's bad.

There are other difficulties, but I was given the impression that they had been solved, or were unimportant. (How gullible can you get?)

It seemed to me that the "simple" solution was easy. I still think so. But I have spent two-and-a-half years trying to *keep it simple.* It ain't easy. If I may paraphrase:

Simple problems bring other problems

No matter how you write 'em

And these problems get other problems

And so forth, ad infinitum!

The simple solution was this: If a dip in an otherwise gas-filled flexible tube holds some liquid, and the dip is moved along the length of the tube (Fig. 1), the liquid will tend to move

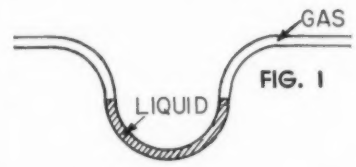


FIG. 1

with the dip. If, however, the end of the tube toward which the dip is being moved is stopped, the liquid in attempting to follow the dip will compress the trapped gas somewhat. And the compressed gas, pushing back, will create a hydraulic "head" across the dip proportional in height to the pressure created (Fig. 2). If, instead

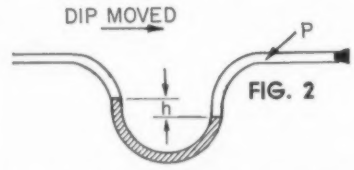


FIG. 2

of one there are several such dips, it can be seen (Fig. 3) that the total

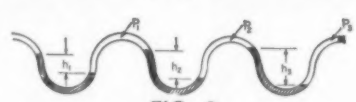


FIG. 3

pressure created will be proportional to the sum of the hydraulic heads across each dip.

Now if the movements of these dips along the tube can be mechanized, the resulting device can be used as a pump. A simple way of doing this, and of supplying new dips as old ones move along, is to wind the tube

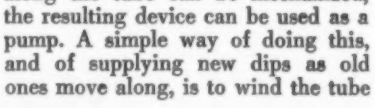


FIG. 4

FIG. 5. McLEOD and the MAC pump.

in a horizontal helix and revolve it about its axis (Fig. 4). That, basically, is the MAC Pump (Fig. 5). Needed are only an inlet for the gas (oxygen) and liquid (blood), an outlet with a float valve to vent the gas while holding pressure on the liquid, rotating points to connect them to the tube, and a motor to turn the helix.

Simplicity! Only one moving part (other than the drive). No valves (in the blood), no occluding passages, and no fast-moving parts (the helix turns about 10 rpm). No separate "lung." (The lung function is "lagniappe." As the top half of the helix must be filled with some kind of gas anyway, the use of oxygen allows the necessary oxygenation of the hemoglobin to take place at the interface with the blood film on the inside of the tubes.) No turbulence to cause foaming. Easy to understand, no special "crew" required. Easy to clean (all parts touching blood can be disposable and replaceable at nominal cost). It is comparatively small, light, and inexpensive (approximately $1000), and (on experimental animals—no people yet) it works!

Maloney on Problems in Human Simulators

The final speaker of the meeting was our host, *James Maloney* (M.D., UCLA Department of Surgery).

Dr. Maloney commended the Western Simulation Council for arranging such a meeting because "we have become so specialized in our own fields that often we don't know or appreciate what is going on in adjacent areas."

Commenting on the vast amount of progress made in the physical sciences using computers and simulation for the analysis and synthesis of complex physical systems, Dr. Maloney remarked (and we will leave it as an exercise for the reader to determine just how seriously), "Physics is passé; medicine is now the frontier science!"

Dr. Maloney went on to back up his remark by pointing out the tremendous scope of medical "worlds to be conquered," the breadth and depth of problems to be solved, and the importance to all of us of getting on with the job.

"We only know," he said, "perhaps 2% of what we should to understand the human system—and we are only able to use perhaps 10% of what we know."

To improve these figures, all possible tools and techniques must be brought to bear, and we in the computer field are certainly in a position to make vital (literally) contributions.

The over-all task is too bewildering for comprehension, but some idea of its challenge may be gathered by considering some of the problems of extra-corporeal perfusion, an area in

We have been swamped by requests to be added to the mailing list of MEN. It has just not been possible to handle all these requests before this issue went to press. We therefore ask prospective readers to bear with us.

which Dr. Maloney is much interested.

As we have already stated, there are problems of hemolysis (mechanical damage to the blood) and foaming, but that's only the beginning. Assume for the moment that you have a perfect mechanical device: when that device is connected to and becomes part of a biological system what do you have? The heart-lung machine has only two functions: to pump and to oxygenate. These can be described by three parameters: pressure, flow, and percent saturation. But they are interrelated with each other, not only in the physical but most importantly in the biological system.

For instance, the flow into the biological system is a function of both pump pressure and system resistance. And the latter can and does change in what appears to be an arbitrary manner.* So what do you control? Pump pressure? Keep the flow at the desired rate? Keep arterial pressure at a pre-selected level? Or hold a constant venous pressure?

And what of oxygenation? Is it possible to over-oxygenate? Hyperventilation (deep breathing) in vivo (in the normal body) can cause dizziness. Under some conditions (under water, for instance) breathing pure oxygen can cause oxygen narcosis. Are we liable to do this to our patients? If so, is it dangerous? Just what is the mechanism of oxygen narcosis anyway?

And how about CO_2 removal? This is as much a function of normal breathing as O_2 uptake. If the CO_2 formed by burning oxygen in the biological system is not removed, the pH (acidity) of the blood goes down and the entire chemical balance is upset.

These are only a few of the many things we would like to know more about. Yet they are selected from a very specialized area in which, surprisingly enough, the doctors (with some assist from engineers, of course) have performed miracles. How much better could they do here if we could help them get more answers? And how many "miracles" could they perform that are only dreamed of now.

It's *our* ball!**

After his talk Dr. Maloney introduced the engineer of his group who is in charge of their heart-lung machine.

The UCLA machine, assembled from "off-the-shelf" basic components, has some interesting features of convenience and control. However, the pumping is accomplished by perhaps the most popular type of pump, and the oxygenation by one of the most popular oxygenators.

The pump is a section of elastic tubing held in a semi-circle by a stationary backing, while two rollers on opposite ends of an arm rotating about its center(which is concentric with the center of the semi-circle) compress the walls of the tubing to force the blood in the direction of rotation.

The "lung" consists of a series of discs housed in a horizontal cylinder and turning about a common axis so that they dip into blood flowing through the bottom of the cylinder. As the discs turn, this creates a film which in the upper section of the cylinder is exposed to oxygen and oxygenation of the hemoglobin takes place.

This device was demonstrated to the group. It was pumping water instead of blood, and there was no "patient." Nevertheless, the demonstration was interesting—and probably just as realistic as many of the group would like it to be!

*Of course it isn't, but I have to find anyone who can predict or control it! —Ed.

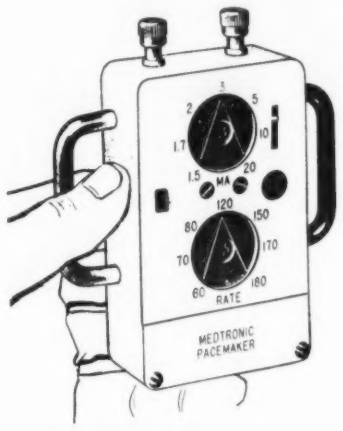
**In this case "having a ball" is real serious business!—Ed.

BRIEFS

FOR MORE DATA, CIRCLE NUMBER ON CARD.

Cardiac Pacemaker

Attached to and worn by the patient, the Medtronic Cardiac Pacemaker stimulates ventricular function in cases of atrioventricular dissociation that are induced during the surgical repair of septal defects, or that occur spontaneously as in Strokes-Adams syndrome.



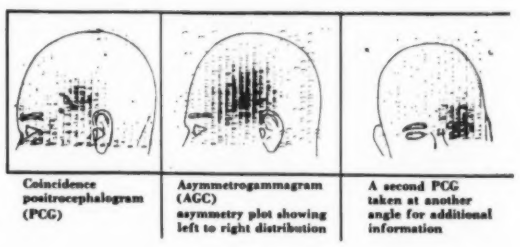
The Pacemaker is designed for internal applications with at least one wire attached directly to the myocardium for temporary stimulation or with a bipolar patch for prolonged stimulation . . . Neon flasher indicates function of Pacemaker. It may be disconnected by interchanging the screws on the front panel to extend the life of the Pacemaker battery, if desired . . . (*From new 36-page booklet "Medical Engineering"—Medtronic Inc., 818 Nineteenth Ave. N.E., Minneapolis 18, Minn.*)

FOR THIS LITERATURE CIRCLE 33 ON READER-SERVICE CARD

Positron Scanner

When certain radioactive tracers are introduced, tumors take up these substances at different concentrations than normal regions. Radioactivity distribution measurements then made with the Positron Scanner Localization by this technique is a promising new diagnostic method . . .

The Positron Scanner utilizes positron (positive beta-particles) emitting radioisotopes. The isotopes emit positrons which are stopped almost immediately in tissue. When the positron stops, it combines with an atomic negative electron and both are completely "annihilated." The masses of these two electrons are converted to "back-to-back" gamma rays of about one-half an MEV each. These gammas are emitted simultaneously and in almost exactly opposite directions. The gamma rays are detected by scintillation crystals . . . (*From new 62-page Catalog A-4 "Atomic Instruments and Systems," Baird-Atomic, Inc., 33 University Rd., Cambridge 38, Mass.*)



Coincidence positrocephalogram (PCG) | Asymmetrogammagram (AGC) asymmetry plot showing left to right distribution | A second PCG taken at another angle for additional information

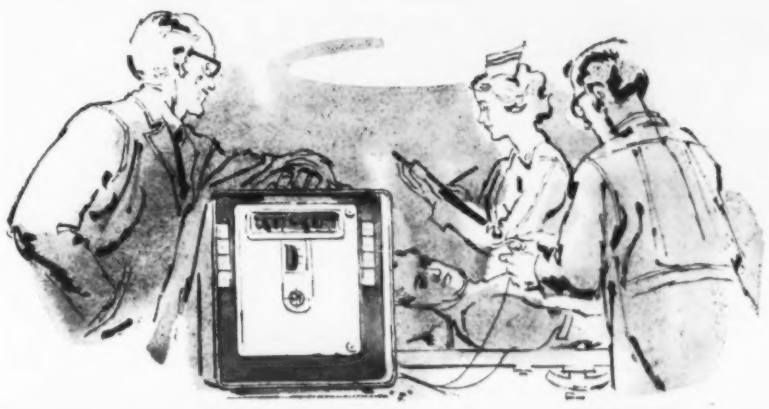
FOR THIS LITERATURE CIRCLE 34 ON READER-SERVICE CARD

AEC Awards Contract

MT. VERNON, N. Y.—The Atomic Energy Commission has acknowledged Consumers Union's nonprofit research efforts in tracking down strontium-90 and other radioactive elements in typical daily diets, by awarding CU a $20,000 contract.

Samples of typical daily diets will be collected and packaged in 25 cities all over the country, and shipped to CU's consultant radio-chemistry labs. In addition to strontium-90, seven other radioactive elements will be included in the study. Special attention is being paid to the great variety of teen-age food and snacks, and the samples will include also samples of water consumed.

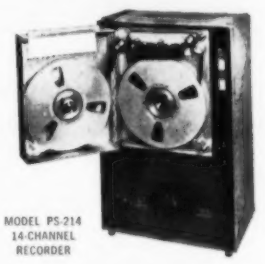
BLONDER-TONGUE FOUNDATION, 9 Alling St., Newark, N. J., offers an internship at the Institute for Advancement of Medical Communications for the purpose of studying the latest techniques of closed-circuit TV.



PRECISION Magnetic Recorders add new dimension to medical instrumentation

The new dimension—added to magnetic tape's already impressive list of capabilities as a medical tool for capturing and preserving physiological data—is *portability*. The new Precision medical instrumentation recorder now makes it practical to acquire physiological variables under a greatly extended range of circumstances—in experimental or research laboratory, hospital, home, or under field conditions.

The Precision recorder enables measurement of diverse medical parameters with extreme accuracy and reproducibility—encephalography, electrocardiography, heart sounds, respiration rate and volume, muscular activity, nerve impulses, blood pressure, temperature, radioactive isotope movement—all these and many other measurements, once possible only through the use of heavy, complex, permanently-mounted equipment, are now practical with a portable instrument only 18" high and weighing 65 pounds. Write for specifications.



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- ★ Time is set by the center knob
- ★ Side levers energize alarm and start clock

The case is made of durable metal and is attractively finished in black wrinkled enamel which outlasts cases made of plastics.

Dial is 3½ ins. in diameter. Timer measures 4¾" x 4¼" x 2¼" and weighs 20 ounces.

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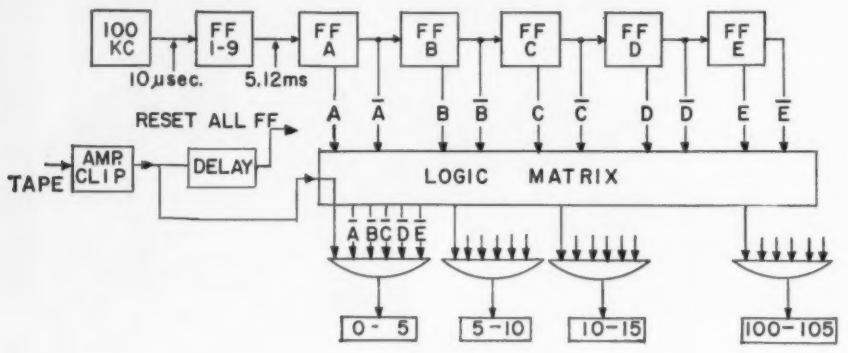


FIG. 1. FLIP-FLOPS A to E develop logic signals for "time basket." Any pulse interval between 0 and 5 ms is counted in first counter, 5-10 ms in second counter, etc.

Pulse Analysis by Histogram

V. J. CAGGIANO

Applied Physics Laboratory
The Johns Hopkins University

In neurological work it is necessary to obtain histograms—frequency distribution of pulse signals in nerves. This is done by measuring the interval between the pulses, and counting the number of pulses separated by any given interval.

NEUROLOGICAL studies conducted by the Central Laboratory Machines group of the Applied Physics Laboratory in conjunction with Walter Reed Medical Institute include recording on magnetic tape the electrical output of nerve cells of cats, with various forms of stimuli. The electrical outputs of these nerve cells usually appear as irregularly-spaced pulses of constant amplitude and width (Fig. 2).

At present there are two viewpoints concerning the form in which intelligence is contained in the neuron's electrical output. One viewpoint is that the pulses are in the form of a code contained in the pulse *spacing* because the other parameters (such as amplitude and pulse width) appear to be fixed. The pulse-coding hypothesis is largely accepted at the Applied Physics Laboratory (but not by the writer) and, therefore, there is a need for decoding techniques in order to pursue this hypothesis.

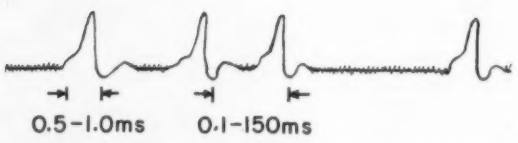


FIG. 2. NERVE-CELL IMPULSES are irregularly spaced pulses of fairly constant amplitude and width. Pulse duration is from 0.5 to 1 ms; interval between pulses is from 0.1 to 150 ms.

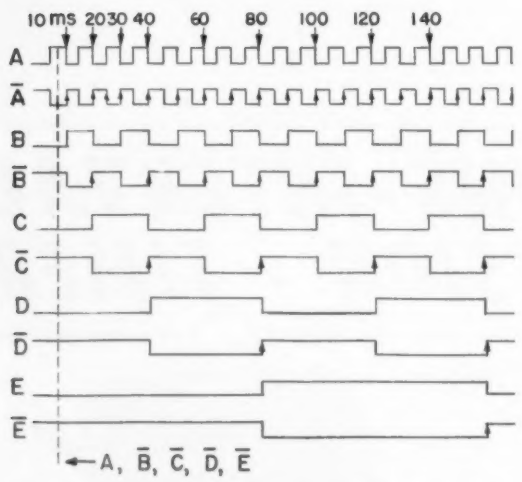


FIG. 3. SIGNALS FROM FLIP-FLOPS A to E. In any one 5-ms interval, there is a unique set of signals. In 5-10-ms interval the positive signals are on lines A, B̄, C̄, D̄, Ē.

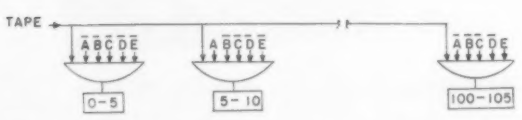


FIG. 4. FIVE SIGNALS from a set of five flip-flops establish a series of "time baskets." For example, first gate (with inputs Ā, B̄, C̄, D̄, Ē,) is open for 0-5 ms. If signal from tape arrives in this interval, it is counted in Counter 1. Second gate is open only during interval 5-10 ms, etc.

Frequency Distribution of Pulses

One method analyzes spacing between any two consecutive pulses. A plot of the number of times an interval occurs (that is, the number of pulses with given spacing) versus pulse spacing results in a *histogram.* (Another decoding technique being investigated at the present time is an *autocorrelator.*) If the assumed hypothesis is valid, and if the information content can be related to pulse spacing, an entirely new type of code may evolve. This could possibly change known transmission techniques, digital computer operations, or open doors to a new type of mathematics.

The method used to obtain the histogram uses only a few basic circuits—primarily flip-flops and AND gates. The flip-flops are used to establish a set of 5-millisecond time intervals (or "time baskets"). The intervals are 0-5 ms, 5-10 ms, 10-15 ms, etc. (Figs. 1 and 3). Each time-basket drives a separate counter. The 0-5 ms counter shows the number of pulses that arrived less than 5 ms after a preceding pulse. The 5-10 ms counter reads out the number of times that the interval between pulses was 5 to 10 ms, etc.

Circuitry

The basic circuit is the "time basket"—a timing circuit that develops successive intervals—0-5 ms, 5-10 ms, 10-15 ms, etc.

This is done by enabling a gate with five signals from a series of five flip-flops (A-E in Fig. 1). The A signals are from flip-flop A, the B signals from B, the C signals from C, etc.

If the input to flip-flop A is a series of 5-ms pulses, then the output of A is a series of 5-ms square waves, as shown in Fig. 3. The output of flip-flop B is then a 10-ms square wave, the output of C is a 20-ms square wave, D produces a 40-ms square wave, and E an 80-ms square wave.

If we define the truth statement as a positive-level signal—that is, A exists when the A line is positive, Ā exists when the Ā line is positive, etc., we see that in the interval from 0-5 ms, the positive signals from the flip flops are on lines Ā, B̄, C̄, D̄, Ē. In the interval 45-50 ms, the positive signals are A, B̄, C̄, D, Ē. As there is only one combination of signals for every 5-ms interval, a gate can be enabled by these signals to produce the "time basket."

This is shown in Fig. 4. By enabling each gate with the proper set of five flip-flop signals, each gate is enabled for one 5-ms interval, successively.

If a pulse arrives in any given interval, it completes the number of input signals needed to trigger that gate which has been enabled; the gate actuates the appropriate counter. Thus the nerve pulse is brought to all gates, but actuates only that one which has been enabled.

As every pulse resets the flip-flops, the count begins with every pulse, and ends when the next pulse is sorted into its proper time bin, at which time the process repeats.

As a 100-kc oscillator was available, a series of nine flip-flops divide the 100-kc signal by 2^9 (512). The result is a 5.12-millisecond-duration output (10 microseconds times 512 equal 5120 usec, or 5.12 ms).

The 32 AND gates could be connected simultaneously, and a complete histogram obtained by playing the tape through only once. However, to save counters and gates, the logical selection of variables was done by two pre-wired switches, which enables selection of any two time intervals simultaneously. With only two AND gates, it was necessary to play the tape over ten times in order to get all 20 categories. The only reason for this arrangement is a temporary lack of components.

As tapes are inherently noisy (sometimes as bad as 2:1 signal-to-noise ratio) a clipper was designed which passes only the peaks of the signals. The clipper was made a part of a pulse standardizer; the combination can receive positive or negative inputs and always gives out standard positive pulses. The standardized pulse is 15 volts, adjustable from 0.5 to 2.5 milliseconds.

All circuits (except bias supply) are transistorized and constructed on 4" x 5" plug-in cards. The complete sorter is housed behind a 19" panel, 9" high and 9" deep, except for power supply. The pulse amplifiers provide a convenient way of obtaining a small delay between counting a pulse and resetting the flip-flops. This delay insures that the flip-flops will not be reset during or before the time the input pulse is used to trigger the AND gates. The pulse used internally in the sorter is 2.5 microseconds wide and 10 volts high. Although only a 2.5-microsecond delay is required, a 5-microsecond delay is used to insure reliability.

Many variations are possible. For example, if the output of the AND gate is connected to a recorder, then a time variation of pulse density also would be obtained.

The advantage of making histograms using this sorter technique over reducing the data manually is in the time saved—30 to 1 for short records. Histograms also can be made from longer records (20,000-30,000 pulses), which was virtually impossible previously. Furthermore, no technical skill is required.

This work was supported by the Bureau of Naval Weapons, Dept. of the Navy, Contract NOrd 7386.

DATA

The Conference on Diagnostic Data Processing was reported in the October, 1960 issue of the *IRE Transactions on Medical Electronics*, published by the IRE Professional Group on Bio-Medical Electronics. The following are abstracts of the papers presented at the Conference. Full papers are available in Volume ME-7, No. 4, Oct., 1960 IRE Transactions on Medical Electronics, Institute of Radio Engineers, 1 E. 79th St., New York 21, N. Y.

"The Use of Computer in Physiologic Diagnosis," Donald L. Fry, Natl. Heart Inst., Natl. Institutes of Health, Bethesda, Md.

The major activity of this laboratory is to establish mathematical models that approximately describe the various parts of the cardiovascular and pulmonary systems. With this knowledge descriptive equations can be derived that are suitable for solution by computer techniques. These solutions are of potential diagnostic value.

"Computers and Psychophysiology in Medical Diagnosis," Albert F. Ax, Lafayette Clinic, Detroit 7, Mich.

Apparatus has been designed to sample, digitize, and magnetically record for computer input up to 29 physiological variables as recorded on the intact human. Specialized procedures have been worked out for computing independently on continuous variables the four

Recording Intervals

EDWARD B. YONTEF
HERBERT M. JENKINS

Bell Telephone Laboratories, Incorporated

IT often is desirable in psychological experiments to make pen recordings showing when each of several events occur (e.g., stimuli, responses, reinforcements), and the duration of an event or latency (e.g., the interval between the onset of a stimulus and the response).

Operations recorders (Fig. 1) with event-marking pens are suitable for this purpose. However, a problem in recording arises when the experiment runs over a long period because if the time durations to be recorded and measured accurately are on the order of seconds, a high chart speed is needed. When the experiment runs for several hours, this results in long paper records which are expensive and inconvenient to handle. The problem is to achieve sufficient resolution without using high chart speeds.

The method described here records time durations in a digital form that can be read accurately and quickly. Consecutive intervals of time are marked *across* the chart. Each mark *along* the chart represents 10 time-intervals, or one decade. Thus time has been compressed by a factor of 10 along the chart, and the chart speed can be reduced by a factor of 10 (compared to a standard chain of pulse "pips" made by a single pen), with no loss in resolution.

A block diagram of the recording system is shown in Fig. 2. If a single pulse from a timing pulse (0.1 second) train is fed to a recording pen, it causes a momentary deflection. If the following pulse* is then fed to an adjacent pen, and so on, a staircase sweep of markings along the horizontal axis can be generated. The total number of marks provides a time measure; the frequency (rate of marking) determines the time resolution.

The chart speed only needs to be sufficient to allow the *start* of a decade of marks to be distinct from the preceding decade. A chart speed which suits this purpose for 0.1 second pulses is 3 inches per minute. A tracing of a record is shown in Fig. 3.

FIG. 1. OPERATIONS RECORDER used in study has 20 event-marking pens. (Photo courtesy Esterline-Angus Co., Inc.).

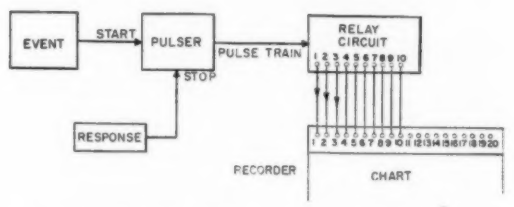


FIG. 2. UPON STIMULUS of the subject, the event box starts the pulse generator. The first time pulse operates pen 1, the second pulse is directed to pen 2, the third pulse to pen 3, etc., by the relay counting circuit. The response pulse stops the pulse generator. Western Electric 291A Mercury Relay can operate at speeds to 50 pulses per second.

*Keister, Ritchie and Washburn, *The Design of Switching Circuits*, p. 255, Fig. 11, 12, Van Nostrand, New York, 1951.

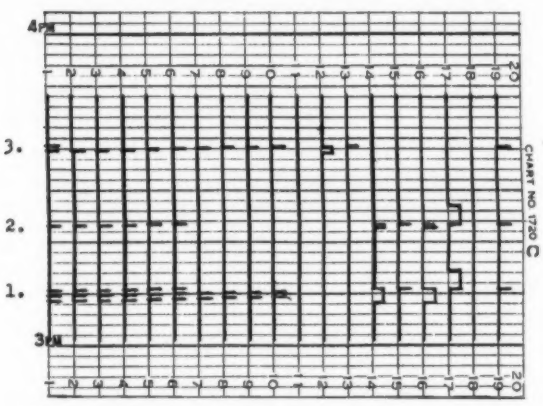


FIG. 3. PENS 1 to 10 display the time measure. User need only count the marks made by pen 10 (2 in example 1) to count seconds. Then the last pen operated in the incomplete decade gives tenths of a second. (2.6 in example 1). Example 2 shows a reading of 0.6 second. Example 3 shows 1.1 seconds. Pens 12 to 20 are used to record stimulus values, responses, and reinforcements.

PROCESSING FOR DIAGNOSIS

aspects of correlation—lag, coincidence, amplitude, and slope.

"Storage and Retrieval of the Results of Clinical Research," Murry Eden, Dept. of Elec. Engrg., Mass. Inst. Tech., Cambridge, Mass., and Natl. Heart Inst., Natl. Institutes of Health, Bethesda, Md.

The problem of retrieval of information from the large volume of clinical literature has received increasing attention in the last few years.

"Diagnosis of Arterial Disease with Analog Computers," Ralph W. Stacy, The Ohio State University, Columbus, Ohio.

Using an analog computer to simulate the behavior of the arterial system, it is possible to compute a peripheral pulse wave which closely approximates the peripheral pulse wave recorded from a patient, when the central pulse wave recorded from that patient is used as a forcing function.

"Using Electronic Computers in Medical Diagnosis," Robert S. Ledley, Member, IRE Natl. Acad. of Sciences—Natl. Res. Council, Washington 25, D. C.

To use electronic computers in medical diagnosis, the mathematical foundation of the medical diagnostic processes must first be well understood. Three mathematical disciplines are involved in the diagnostic processes—logic, probability, and value theory.

"Digital Computer and Medical Logic," R. Ebald and R. Lane., Bizmac Electronic Data Processing Div., RCA, Camden, N. J.

This paper discusses the logical structure of a computer program designed to analyze and determine significant relationships between sets of symptoms drawn from actual case histories and a "classical" set in a group of hematological diseases.

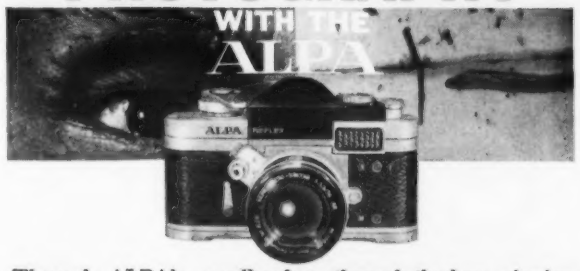
"IBM Type 704 Medical Diagnosis Program," Taffee Tanimoto, IBM Research Center, Yorktown Heights, N. Y.

The basic input to the Type 704 computer is simply the presence or absence of those characteristics of a set of medical cases which are considered to be pertinent by an expert in that particular field. Pairwise and over-all similarity of both the cases and the symptoms are defined so that geometrically the cases, considered as points in a suitable space, form several clumps, thus establishing a natural classification.

"Diagnostic Video Data Processing," Lee B. Lusted, Fellow, IRE, University of Rochester Medical School, Rochester, N. Y.

A particularly interesting application of the spatially oriented computer is to "read" chest X-ray photofluorograms and to separate the obviously abnormal chest films from the normal chest films.

MACRO and MICRO PHOTOGRAPHY



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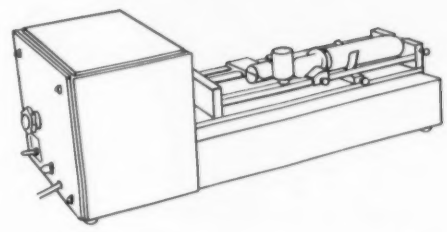

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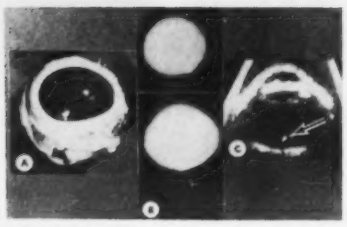

New Ultrasonoscope can visualize soft tissues of the eye and reveal conditions that cannot be detected with other instruments. These include such conditions as a detached retina or a tumor in an eye, opaque because of cataract or hemorrhage, certain types of intra-ocular foreign bodies invisible to x-ray, and lesions behind the eye. Picture shows (A) gross, (B) x-ray, and (C) ultrasonic appearance of a beef eye containing a piece of wood in the vitreous. Arrow on ultrasonogram points to sonic image of wood, invisible to x-ray localization. The precise position of the foreign body as to depth and azimuth may be found directly by ultrasonic locator.—*GPL Div., General Precision, Inc., 63 Bedford Rd., Pleasantville, N. Y.*

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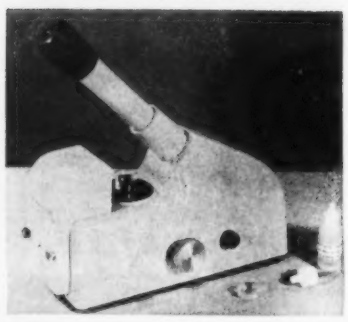
SERUM PROTEIN METER



New Serum Protein Meter Model 35-45-87-01 provides accurate three-step protein analyses in as little as one-tenth the time required by chemical methods. No temperature controls are required, other than equal temperatures for both sample and distilled water. Readings are referred to the index of refraction of water. Eyepiece reticle contains two scales; one providing readings in serum protein directly to 0.1 gram, the other, reading in refractive index difference.—*Bausch & Lomb Inc., 90715 Bausch St., Rochester 2, N. Y.*

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OPERATION MONITOR

New Master Monitor gathers and displays information on a patient's condition during all stages of surgery, including pulse rate, direct blood pressure, heart condition, depth of anesthesia and temperature. Data are transmitted to a Central Monitor where they are processed for display and recorded.—*Epsco Medical, Division of Epsco, Inc., Cambridge, Mass.*

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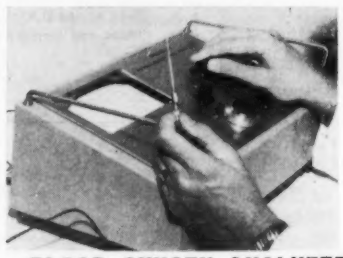

BLOOD OXYGEN ANALYZER

New Physiological Gas Analyzer has a platinum-tipped electrode, 0.0005" dia which can be inserted into blood vessels, arteries, other body fluid reservoirs, even the brain itself. In place, the electrode produces direct oxygen readings, in contrast to standard techniques which require withdrawal of samples for oxygen measurement.—*Beckman Instruments, Inc., 1117 California Ave., Palo Alto, Calif.*

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HEART MICROPHONE

Microphone for direct insertion into heart is 1/20th inch in diameter and 3/4 inch long. Is inserted into tip of standard cardiac cathetometer and connected to oscilloscope by cable. Permits physicians to diagnose sounds of heart ailments directly at point of defect. Not only eliminates the many extraneous sounds of stethoscope but permits diagnosis and localization of many types of heart ailments. Sound energy can also be displayed as scope pattern for visual analysis.—*Gulton Industries, Inc., Metuchen, N. J.*

CIRCLE 39 ON READER-SERVICE CARD

MICROCIRCUITRY TRANSMITTER

New microminiature Transmitter, so compact that the entire unit including its battery is mounted as a tooth in a dental bridge, performs the same functions as a standard radio transmitter. Microcircuitry involves circuit fabrication in a vacuum chamber by vapor depositing several basic materials in the proper pattern on a wafer of ceramic. The transmitter and mercury cell battery are then molded with an epoxy resin into the shape of a tooth. In addition to dental research, the extreme small size (0.02 cu in) and weight (1.2 grams) of the transmitter permits, for example, incorporation into a capsule to be swallowed, thus permitting the monitoring of digestive processes in the body.—*Varo, Inc., 2201 Walnut St., Garland, Texas.*

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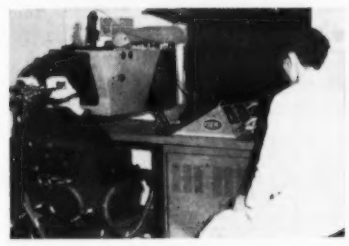
PUPILLOGRAPH



New Electronic Pupillograph records pupillary movement using pupil reactions to indicate the presence of lesions within the nervous centers and pathways of pupillary control. Normal pupillary reflexes conform to a definite pattern under a given set of experimental conditions, but lesions at specific sites cause specific changes in the pupillary reflex pattern.—*GPL Division, General Precision, Inc., 63 Bedford Rd., Pleasantville, N. Y.*

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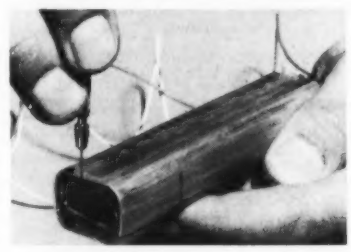
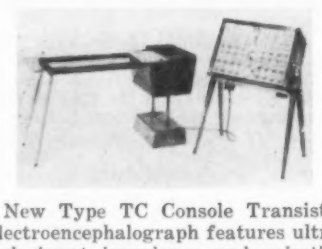
RADIATION DETECTOR



New Radiation Detector measures amount of radiation man will meet in space. Packaged with signal amplification units in small, cigar-size cylinders, detector is essentially a thin slice of silicon. Telemeter system transmits the signals to receiving stations on earth as the vehicle moves through space.—*Hughes Aircraft Co., Florence Ave., Teale St., Culver City, Calif.*

CIRCLE 42 ON READER-SERVICE CARD

ELECTROENCEPHALOGRAPH



New Type TC Console Transistor Electroencephalograph features ultra-high input impedance and rejection ratio, precision linearity and frequency response. An all-transistor design, it is available with from 2 to 16 channels.—*Offner Electronics Inc., 3900 River Road, Schiller Park, Ill.*

CIRCLE 43 ON READER-SERVICE CARD

Cardiac Resuscitation System

New Cardiac Resuscitation System combines two new transistorized instruments: a small, portable, self-powered cardiac pacer and a bedside monitoring unit that will respond to indications of heart arrest by switching the pacer into operation and by signalling an alert via radio. The cardiac pacer is essentially a

compact source of periodic electrical stimuli whose pulse rate and amplitude are adjustable over wide ranges. Contains its own source of electrical energy in the form of mercury batteries. The cardiac monitor constantly monitors the patient's heartbeat and, in the case of heart arrest, causes the pacer to begin stimulation of the patient's heart at a preset rate and amplitude. An integral radio transmitter broadcasts a coded alarm signal in case of emergency. Signal can be received at distances above 2½ miles by a receiver about as large as a package of cigarettes. . . . (*Westinghouse Electric Corp.'s X-ray and Industrial Electronics Div., 2517 Wilkens Ave., Baltimore 3, Md.*)

FOR MORE INFORMATION CIRCLE 44 ON READER-SERVICE CARD

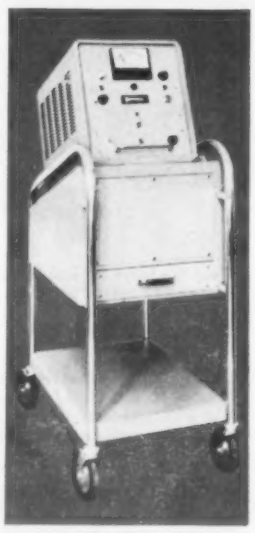
Closed-circuit TV in Medical Diagnosis

SAN DIEGO, CALIF.—One of the first areas invaded by closed-circuit TV was the hospital operating room. These systems are widely in use to give large groups of students a first-hand look at delicate surgical operations. With newer, more sensitive systems available, closed-circuit TV is finding even wider applications in hospitals, medical schools, dental colleges, and similar institutions.

In the dental field, closed-circuit systems have proved of great benefit in instruction and diagnosis. Picture shows a system presenting a view of the *back* of a patient's tooth on the viewing monitor. This is accomplished by using a flexible optical fibre probe to magnify and send the image to a sensitive vidicon camera. The image is shown on a 14-inch monitor, allowing a detailed view for diagnosis or presentation to a student audience. (System is produced by Kin-Tel, Div. of Cohu Electronics, 5725 Kearney Villa Rd., San Diego 12, Calif.)

FOR MORE INFORMATION CIRCLE 45 ON READER-SERVICE CARD

MICROFLO ELECTRO-MAGNETIC BLOOD FLOW-METER



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8	18	28	38	48	58	68	78	88	98	108	118	128	138	148	158	168	178	188	198
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What variables *can't* you measure satisfactorily? .....

.....

In what application/s? .....

Units and range of measurement required? .....

Present technique/s being used? .....

.....

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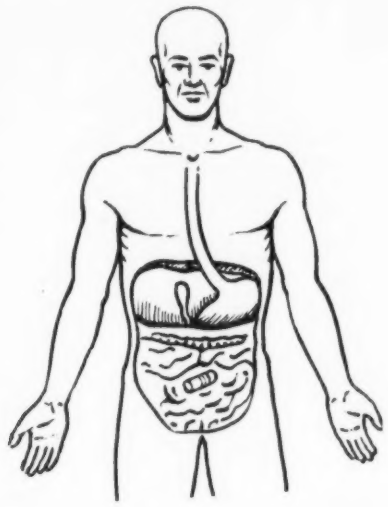
Pressure Transensor

The Pressure Transensor, an ingestible pressure-sensitive telemetry capsule, and its associated receiver are . . . for original investigations on the motility of the gastrointestinal tract . . .

The pressure-sensing mechanism is a miniature

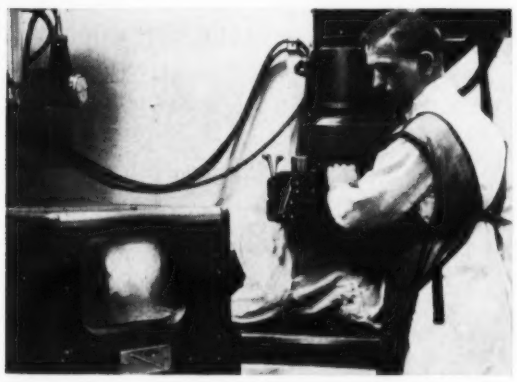


nickel bellows. Pressure acting against the bellows causes it to change the inductance of an internal battery-powered transistor oscillator. This change in inductance modulates the frequency of oscillation. The frequency-modulated signal is transmitted to a receiving antenna located a short distance from the subject. An FM receiver demodulates the signal and produces an output voltage proportional to the original pressure variations. The output is recorded on a standard oscillograph . . . (*From 4-page bulletin, Airborne Instruments Lab., Div. of Cutler-Hammer, Inc., Deer Park, L. I., N. Y.*)

FOR THIS LITERATURE CIRCLE 46 ON READER-SERVICE CARD

X-Rays and TV Join Forces

NEW YORK, N. Y.—At a luncheon of the American College of Radiology, Dr. Russell H. Morgan, professor of radiology at Johns Hopkins University, demonstrated an image intensification system which allows viewing of x-ray pictures in daylight on a screen, while the patient is being examined.



In the system, x-rays are converted into greatly intensified light rays before striking the fluoroscopic screen. This procedure does not only take such examinations out of the darkened room with its inconveniences and time delay for the eye to accommodate to the darkness, but affords also the possibility for viewing by a large audience and even the patient himself. Normal x-ray dosages are applied, as intensification from x-rays to light rays on TV system coupled with electronic image tubes is 50,000 times.

SPACELABS, Inc., under a contract from the USAF School of Aviation Medicine, is developing a wireless physiological monitoring system ("Biotel"). With the aid of a tiny radio transmitter, the system will give a ground station the facilities to watch an astronaut's cardio-vascular and respiratory system, as monitored by suitable sensors. A modification of the system under study would allow a nurse in a hospital to maintain constant vigilance over an entire floor. (Spacelabs, Inc. is located at 14819 Aetna St., Van Nuys, Calif.)

FOR MORE INFORMATION CIRCLE 47 ON READER-SERVICE CARD

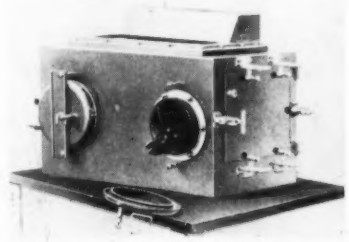
". . . Medical science no longer stands apart from other scientific disciplines. Each year medical research is being directed more and more to fundamental chemical, physical and mathematical approaches to the understanding of life. The requirement is ever increasing to blend knowledge of physical sciences together with that of the life sciences . . ." (Lt. Gn. Arthur G. Trudeau, Army Chief of Research and Development, at Ninth Meeting of Army Key Scientists at Brooke Army Medical Center, Houston, Texas.)

HEMOGLOBINOMETRY

The "25" Photo-Hemoglobinometer is a miniaturized spectrophotometer designed specifically for on-the-spot, direct-scale reading of hemoglobin concentration in whole blood. The analysis takes approximately 3 minutes and is simple. The result is read directly from the instrument in grams of hemoglobin per 100 ml of sample. There are no slides to prepare and no references to graphs or tables.—*Coleman Instruments Inc., 42 Madison St., Maywood, Ill.*

CIRCLE 48 ON READER-SERVICE CARD

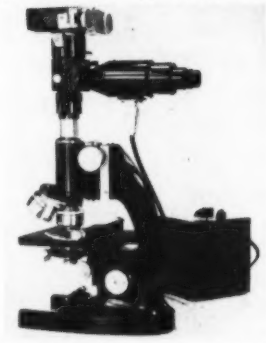
GERM-FREE CABINET



New Double-Incineration Accessory for the Isolator/Lab keeps the interior, once it's been sterilized, germ-free. Any organisms in the air *entering* the sealed unit are removed by a high-efficiency filter system or killed by incineration at 750°F. Any organisms in the air *exhausted* from the Isolator/Lab are destroyed and removed by the same process.—*Fisher Scientific Co., 717 Forbes Ave., Pittsburgh 19, Pa.*

CIRCLE 49 ON READER-SERVICE CARD

UV PHOTO-MICROSCOPE



Ultraviolet photo microscope Model 31-51-47-01 permits visual focusing by use of the RCA ultrascope tube for examination of specimens under ultraviolet light, such as tissue cell screening, bone marrow observation and the determination of hemoglobin in liver.—*Bausch & Lomb Inc., 90715 Bausch St., Rochester 2, N. Y.*

CIRCLE 50 ON READER-SERVICE CARD

PRECISION DISPENSER

New Miscomatic Dispenser with an all-glass valve system, extends automatic quantitative dispensing procedures to all laboratory tests. Instrument has a guaranteed accuracy of 1% and a reproducibility of 0.4%.—*Microchemical Specialties Co., Berkeley 10, Calif.*

CIRCLE 51 ON READER-SERVICE CARD

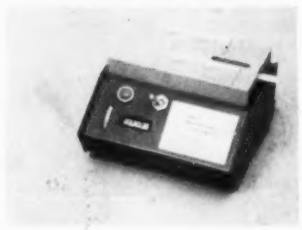
For More Information on Products Listed Circle Number on Index Card

PHOTRONREFLECTOMETER

New research project for the identification of pathological conditions through analysis of serum protein uses a photronreflectometer where specimens are inserted into the cell holder to measure the extent of diffusion between serum carefully layered above a rabbit antiserum-agar mixture in a glass ampule.—*American Instrument Co., Inc., 8030 Georgia Ave., Silver Spring, Md.*

CIRCLE 53 ON READER-SERVICE CARD

PROTHROMBIN-TIME



New Prothrometer provides a rapid and reliable bedside testing facility for prothrombin time determinations by the one-stage method with continuous temperature control. Applications include: control in anticoagulant therapy, diagnosis in hemorrhagic disorders, observation during pregnancy, and emergency testing in surgery. Combines a thermostatically controlled slide and pipette holder with an electrical timer directly readable to 0.1 sec.—*Oxford Labs., 961 Woodside Rd., Redwood City, Calif.*

CIRCLE 54 ON READER-SERVICE CARD

PNEUMATIC TOURNIQUET

New Montgomery Tourniquet Cuff uses specially developed Regulator which provides the constant pressure required for surgery situations on an extremity as a means of controlling blood circulation. Permits pressure relief without the need for bleeding off total system pressure.—*Robertshaw-Fulton Controls Co., 911 East Broad St., Richmond 19, Va.*

CIRCLE 55 ON READER-SERVICE CARD

NEGATIVE ION GENERATOR

New portable Ionaire generates more than a billion negative ions/sec in operation, by weak beta emission from tritium sealed in titanium foil. Medical resarchers have shown that negative ions, in sufficient quantity, can bring about improved ciliary action in the trachea, reduction in nose and throat congestion, and relief from breathing difficulties.—*United States Radium Corp., Morristown, N. J.*

CIRCLE 56 ON READER-SERVICE CARD

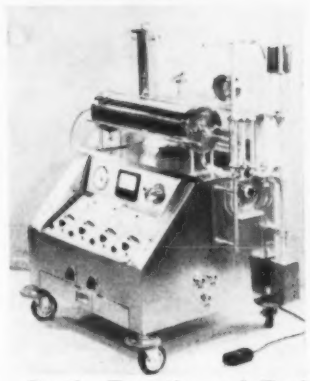
LEAD AIR MONITOR

New Monitor automatically measures particulate lead matter in air. Samples of air are drawn through filter coupons and inserted into the monitor. Lead per m^3 of air is read directly in micrograms and recorded on a strip chart recorder.—*National Spectrographic Laboratories, Inc., 6300 Euclid Ave., Cleveland, Ohio.*

CIRCLE 57 ON READER-SERVICE CARD

MECHANICAL HEART-LUNG APPARATUS

WITH BUILT IN
- QUALITY
- COMPACTNESS
- VERSATILITY



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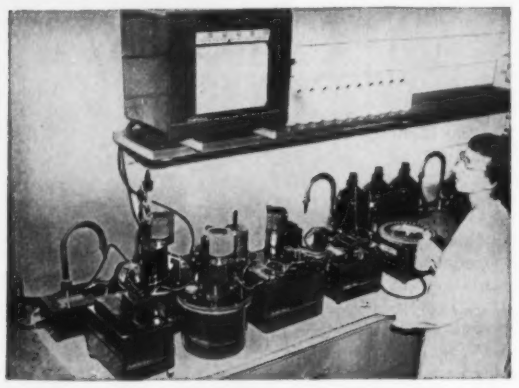
CIRCLE 13 ON READER-SERVICE CARD

Automatic Chemical Analysis Aids Tobacco Research

CHAUNCEY, N. Y.—Chemical analyses performed in the analytical laboratory by the Research Center of Philip Morris Inc. have increased five-fold by use of an AutoAnalyzer, a product of Technicon Controls, Inc. The AutoAnalyzer is automating such analyses in



tobacco chemistry as reducing sugars (glucose), ketose sugars (fructose), total reducing substances in tobacco and smoke, and neutral and acidic reducing substances in smoke. Additional determinations, including chlorides, micro-glucose, and carbon dioxide are presently being considered. This automatic chemist runs as many as 20, 40, or 60 tests/hour, as desired, without human interposition. (For more information contact Technicon Controls, Inc., Chauncey, N. Y.)

FOR MORE INFORMATION CIRCLE 58 ON READER-SERVICE CARD

Physical Data from Space

NORTH HOLLYWOOD, CALIF.—Electronic medical data will be radioed back to earth when America's first astronaut will orbit the globe in his Project Mercury capsule.

The Bendix Corporation's Bendix-Pacific division (11600 Sherman Way, North Hollywood, Calif.) is equipping the special ground stations, being set up in all parts of the world, with the telemetering systems that will receive data on the spaceman's pulse, temperature, respiration, physical reactions, and oxygen consumption. These measurements will constitute only part of the 90 different variables that will be transmitted to earth, reporting on the vehicle and its passenger's functioning.

As each station receives the information, it will be transmitted to a central computing installation in Greenbelt, Md. where it will be displayed and recorded for immediate and future observations.

FOR MORE INFORMATION CIRCLE 59 ON READER-SERVICE CARD

Ear Protection

PITTSBURGH, PA.—At NASA's Flight Research Center, Edwards, Calif., as much attention is now paid to ear protection of the ground crew, as was paid in the early days of jet aircraft operation to protect the airborne crew.

Head-set type ear protectors manufactured by Mine Safety Appliances Co. (201 N. Braddock St., Pittsburgh 8, Pa.) have proved to lessen the effects of long noise exposures considerably. Ground crews, during their daily 8-hour shift, are often exposed to noise levels ranging above 100 decibels. Aircraft maintenance crews have to endure noise levels reaching 130 plus decibels. Psychological and physiological effects of such exposures have been studied and remedial measures have been suggested.

FOR MORE INFORMATION CIRCLE 60 ON READER-SERVICE CARD

MINNEAPOLIS-HONEYWELL is the developer of a space-cabin simulator in which two Air Force volunteers at the School of Aviation Medicine at Brooks Air Force Base last fall lived for thirty days in space-travel-like isolation with all facilities of a self-contained unit for breathing, eating, drinking, and personal hygiene. The atmosphere control system is based on chemical absorption and catalytic filters, temperature and humidity are controlled, and solid wastes are dehydrated and burned, with disposal of the gases produced by an afterburner. The remains are a small amount of fine ash. A vacuum distillation system affords use and re-use of waste water.

PRECISION ANALOG RECORDER

New portable 2-channel Model 102A Record/Reproduce System for research use employs the unique pulsed FM principle and highly developed transistorized circuitry to achieve 0.2% precision in recording and reproduction of all analog data from 0 to 400 cycles. Features include: 3 tape speeds, wide dynamic range, independent record and reproduce channels, low noise and low crosstalk.—*Mnemotron Corp., 3 North Main St., Spring Valley, N. Y.*

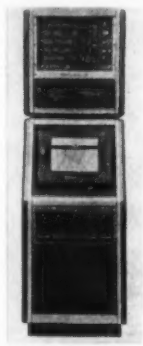
CIRCLE 61 ON READER-SERVICE CARD

MEDICAL MONITOR SYSTEM

New portable CANDU Monitor system, modified for medical monitoring and research, is built for monitoring 25 low level d-c transducers with an accuracy of 0.1% without recalibration for long periods. Results are tabulated and printed along with channel or patient number on electric typewriter or printer. Readings can also be placed on perforated tape; 5 readings a second. System can be modified to handle up to 300 inputs of high or low level information. Input is fully differential, isolated, and high impedance, compatible with medical d-c transducers.—*Communications Control Corp., 14707 Keswick St., Van Nuys, Calif.*

CIRCLE 62 ON READER-SERVICE CARD

PHYSIOLOGICAL MONITOR



New Foxglove physiological monitor system, an electronic digital computer unit, picks up impulses from any part of the human body, shows the data in lighted numbers on a display panel and makes a permanent written record for study by the doctor. This first model already has been utilized for adults and children during open heart surgery. It is also available for use by other hospitals. Details in Bulletin.—*Starling Corp., 2047 Sawtelle Blvd., Los Angeles 25, Calif.*

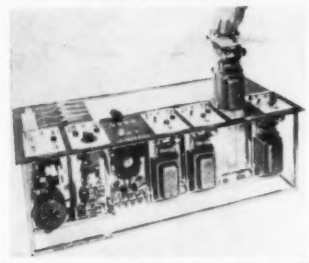
CIRCLE 63 ON READER-SERVICE CARD

QUARTZ CRYSTAL LAPPERS

Two new precision Planetary Lappers for quartz crystal processing feature parallelism within five millionths of an inch and a higher degree of flatness than previously attainable. Model PL-2875-B has a 2⅞" track and ten carriers on work holders with one to six holes, and laps 10 slices to a thickness of 0.008". Model PL-1875-B has a 1⅞" track and 17 carriers, each holding from one to three slices, and can lap 17 slices up to 1" in diameter or 51 smaller slices to a thickness of 0.003".—*Dallons Laboratories, Inc., 5066 Santa Monica Blvd., Los Angeles 29, Calif.*

CIRCLE 64 ON READER-SERVICE CARD

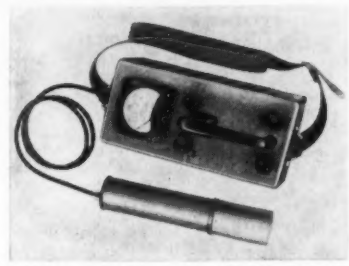
PHYSIOLOGICAL DATA RECORDER



New Physiograph, recording physiological events, features versatility, simplicity of operation, reliability, and accuracy. Dependable voltage regulation within plus or minus 3% is attained by incorporating Constant Voltage Plate-Filament Transformers made by Sola Electric Co., Elk Grove, Ill. Accurate regulation is necessary to obtain reliable recording of blood pressure, electrocardiograms, electrical potentials from the brain, temperature and respiration.—*E & M Instrument Co., Inc., 5815 Sidney St., Houston 21, Texas.*

CIRCLE 65 ON READER-SERVICE CARD

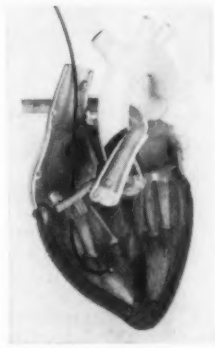
NEUTRON SURVEY METER



New portable Model E-1D Monitor for fast neutron surveys, specifically designed for health hazard survey where fast neutron radiation is encountered or suspected, is largely transistorized. Response is tissue equivalent over a range of 0.2 to 10 mev. Light-weight probe weighs only 17 oz; instrument weighs 6½ lb. Gamma background is effectively eliminated by a discriminating count rate circuit.—*Nuclear Corp. of America, 2 Richwood Pl., Denville, N. J.*

CIRCLE 66 ON READER-SERVICE CARD

STAINLESS CATHETER



New Catheter, a braid consisting of sixteen stainless-steel wires, 0.0036" in diameter, is inserted through a vein at the neck, the superior vena cava, and into the heart. Sometimes the patient's heart regains strength enough to continue itself after a week or two. One patient, however, had to carry equipment for two years. Some may have to carry it for life. Catheter, developed by National-Standard Co., Niles, Mich., is attached to Cardiac Pacemaker, made by Medtronic, Inc., 818 Nineteenth Ave., N.E., Minneapolis 18, Minn.—*United States Catheter and Instrument Corp. (USCI), Glen Falls, N. Y.*

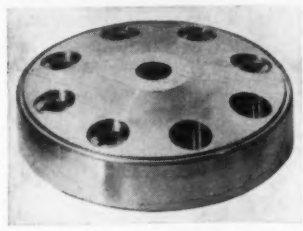
CIRCLE 67 ON READER-SERVICE CARD

VAPOR FRACTOMETER

New analytical Fractometer incorporates Golay (capillary) column and flame ionization detectors, a heated collection system, heat-resistant oven fan, and new temperature control with an improved thermostat amplifier.—*Perkin-Elmer Corp., Norwalk, Conn.*

CIRCLE 68 ON READER-SERVICE CARD

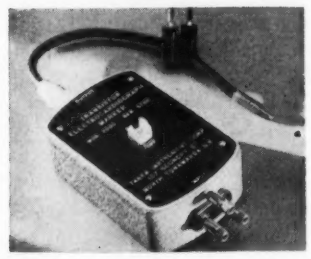
VIRUS COUNTING ROTOR



Superspeed Centrifuge Rotor that has assisted development of new virus counting techniques was designed in close co-operation with Dr. D. Gordon Sharp. Suspended particles are sedimented onto a prepared surface and counted with better than ±10% accuracy. Some viruses can be counted directly in chorioallantoic fluid, blood plasma, or tissue extract. Other microscopic and submicroscopic particles such as mitochondria, bacteria, microsomes, etc. can be sedimented successfully. Eight different materials can be processed simultaneously. Maximum rotor speed is 20,000 rpm, which provides a force of 31,500 G. Bulletin ViRo gives details.—*Ivan Sorvall, Inc., Norwalk, Conn.*

CIRCLE 69 ON READER-SERVICE CARD

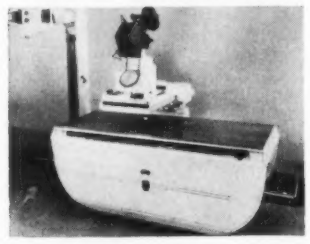
ELECTROCARDIOGRAPH MARKER



Transistor Electrocardiograph QRS marker is specially designed to amplify weak heart voltages (of about 1 millivolt) to 0.5 volt for simultaneous recording with other physiological phenomena. The gain is sufficient for full-scale deflections on nearly all modern cathode ray oscilloscopes. Price List P-58202 gives details.—*Taber Instrument Corp., Section 272, North Tonawanda, N. Y.*

CIRCLE 70 ON READER-SERVICE CARD

IMAGE INTENSIFIER



Up to 1500 times more intensity is provided by a new 9" image intensifier making daylight fluoroscopy practical in medical X-ray examinations. The dangers associated with over-exposure have been practically eliminated since the dosage now required to produce intensified images in a lighted room is but a fraction of that needed under the old system. Fluoroscopy can now be carried on with a minimum of scanning and this permits regular use in routine diagnosis. The large diameter screen accommodates images of the entire skull, the area from esophagus to duodenum, and the heart, even when enlarged.—*North American Philips Co., Inc., Medical and Dental Div., 525 West 52nd St., New York, N. Y.*

CIRCLE 71 ON READER-SERVICE CARD

MOTION SPEED RECORDER

An operator can wear on his wrist a small cylindrical emitter from which two thin wires run overhead to an oscillator that generates ultrasonic waves which are received by three microphones. Instruments connected to the microphones analyze and record the motions of the hand-displacement of position, velocity, and acceleration. Because of the locations of the microphones, the movements are reported in three dimensions. The emitter also has been attached to an operator's knee. It is small enough to make into a finger ring.—*Washington University, Office of Information, 6740 Millbrook Blvd., St. Louis 5, Mo.*

CIRCLE 72 ON READER-SERVICE CARD

TRANSISTORIZED ECG

Transistors and printed wiring panels are incorporated in new electrocardiograph half the size and weight of existing types. Direct-writing Model 300 "Visette" ECG is the size of a small overnight case and weighs 18 pounds.—*Sanborn Co., Waltham, Mass.*

CIRCLE 73 ON READER-SERVICE CARD

LABORATORY MICROSCOPES

New DynaZoom Microscope line, especially created for laboratory use in educational institutions, public health and hospital laboratories, etc. features a completely integrated zoom optical system eliminating image blackout and focus shift, while permitting continuous, crystal-clear magnification within the entire range of the instrument. The magnification range of the series extends from 17.5x to 1940x. Photo-binocular model with Polaroid Land camera attachment for photomicrography is illustrated.—*Bausch & Lomb Incorporated* 90715 *Bausch St., Rochester* 2, *N. Y.*

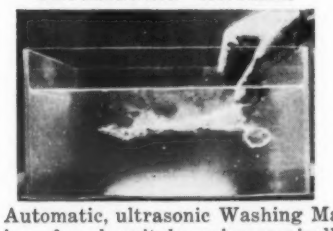
CIRCLE 74 ON READER-SERVICE CARD

CARDIAC RESUSCITATOR

New Medtronic Pocket Cardiac Resuscitator stimulates ventricular function in cardiac arrests due to drug and anesthesia reactions and those that occur spontaneously as in Stokes-Adams syndrome. Employs a transistorized circuit.—*Medtronic, Inc.,* 818 19*th Avenue N.E., Minneapolis* 18, *Minn.*

CIRCLE 75 ON READER-SERVICE CARD

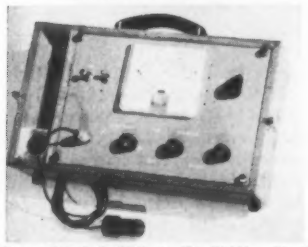
ULTRASONIC WASHER



Automatic, ultrasonic Washing Machine for hospitals microscopically cleans soiled surgical instruments. Transparent working model demonstrates effectiveness.—*Acoustica Associates, Inc., Mineola, N. Y.*

CIRCLE 76 ON READER-SERVICE CARD

RADIOMETER



New Model HL-4 Stoll-Hardy Radiometer, featuring a redesigned circuit and a redesigned sensing head measures radiant heat.—*Williamson Development Co., Inc.,* 317 *Main St., W. Concord, Mass.*

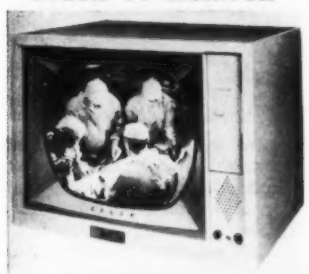
CIRCLE 77 ON READER-SERVICE CARD

PSYCHOLOGICAL DATA RECORD

System records in digital form psychological data from tests of animal behavior under drug and environmental conditions. Input data to the Acquisition Unit are from experimental animal cages. Twenty animal cages are examined 1,200,000 times a minute, twenty-four hours a day. The amplitude of the response signal caused by the activity of each animal is digitized, and the peak value during a given period is recorded on 25-channel tape. Data thus acquired afford the experimental psychologist a means of obtaining a statistical analysis.—*Dykor Systems Div., Digitronics Corp., Albertson, L. I., N. Y.*

CIRCLE 78 ON READER-SERVICE CARD

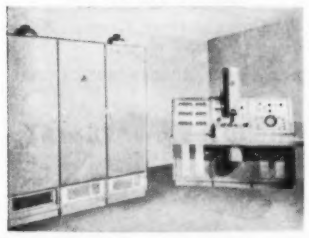
COLOR TV MONITOR



New Model 312-A1 color-TV Utility Monitor, a completely self-contained instrument, provides 21" high quality color or monochrome picture viewing. Separate audio circuits and speakers are provided in the cabinet for monitoring the audio portion of a program, and connections are also provided for an external speaker.—*Telechrome Mfg. Corp., Electronics Div., Amityville, N. Y.*

CIRCLE 79 ON READER-SERVICE CARD

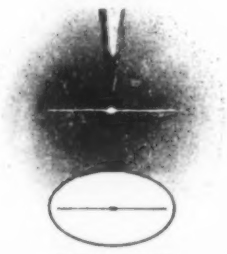
CYTOANALYZER



Type 400 Microscanner is capable of sensing the sizes and absorption of the nuclei of cells. Over 600 tubes decide whether a particle on a microscope slide is a measurable cell, of measuring the area and absorption of nuclei, of classifying each nucleus into a given region, and of totalizing the number of nuclei in each region. —*Airborne Instruments Laboratory, Mineola, N. Y.*

CIRCLE 80 ON READER-SERVICE CARD

PINLITE

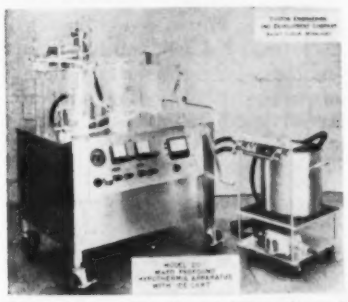


ACTUAL SIZE

New Pinlite, a microminiature incandescent lamp, has only 1/64" dia and 1/16" length, excluding the axial leads which are cut to a nominal 3/8" length. 1.5 vdc @ 15 ma produces 60 millilumens at 1900°C filament temperature, providing a point source of light. Lamps exhibit excellent response to pulses operation at audio frequencies. Life expectancy at 1900°C is in excess of 1000 hours and at reduced voltage the operating life is extremely long.—*Kay Electric Co., Maple Ave., Pine Brook, N. J.*

CIRCLE 81 ON READER-SERVICE CARD

PROFOUND HYPOTHERMIA



New Mayo Profound Hypothermia Apparatus used to induce and reverse profound or deep hypothermia by right and left by-pass, consists of two separate constant-volume reservoir and blood pump systems, heat exchanger, and a blood filter. Features include: Automatic control to maintain a constant volume of blood in the system; pumps are run totally occlusive; arterial filter serves as a bubble trap; arterial line pressure continuously monitored.—*Custom Engrg. & Devel., Co.,* 2647-49 *Locust St., St. Louis* 3, *Mo.*

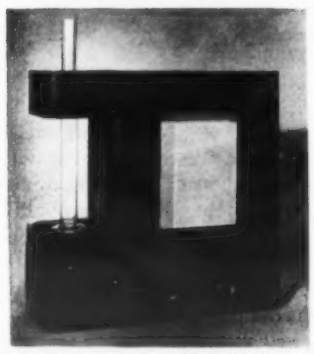
CIRCLE 82 ON READER-SERVICE CARD

ULTRASONIC WASHER

Model H-50 Sonogen cleaner will process surgical instruments from several operations at one time. Cleaning takes only a few minutes, with minimum operator attention. Wash and rinse tanks are 9" x 14" x 13" deep. Protein tissue, and most other contaminants, are quickly and thoroughly removed. Test tubes, syringes, hypodermic needles, glassware and similar hospital equipment are cleaned completely automatically, except for insertion and removal of parts. Even "frozen" syringes, clogged needles, and severely stained instruments can usually be cleaned in the ultrasonic tank.—*Branson Ultrasonic Corp., Dept. MEN,* 40 *Brown House Rd., Stamford, Conn.*

CIRCLE 83 ON READER-SERVICE CARD

MICRON PARTICLE DISTRIBUTOMETER



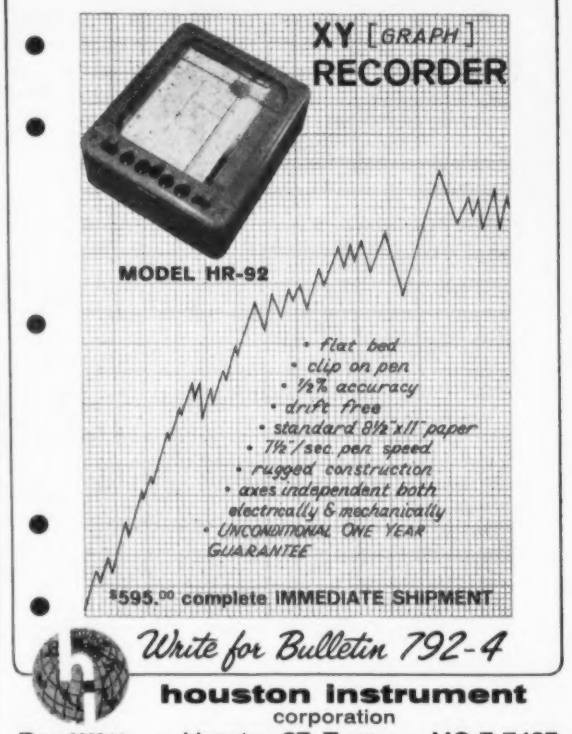
The Micron Particle Distributometer Model A.1 is for continuous recording of weight vs time of any sample particles in the range of 1 to 100 microns as they accumulate on a balance pan by settling in a liquid. From this curve a weight or number distribution may be obtained, i.e., the percent number or weight of particles of each diameter in the sample. —*G. F. Bush Associates, Box* 175, *Princeton, N. J.*

CIRCLE 84 ON READER-SERVICE CARD

GROUND DETECTOR SYSTEM

New Ground Detector System senses the presence of a ground in isolated a-c systems used in anesthetizing areas and gives both visible and audible warning by indicator light and buzzer mounted behind a ground remote indicator panel on the wall. UL approved.—*Custom Control & Mfg. Co., Hospital Product Div., Box* 291, *Buena Park, Calif.*

CIRCLE 85 ON READER-SERVICE CARD



Write for Bulletin 792-4

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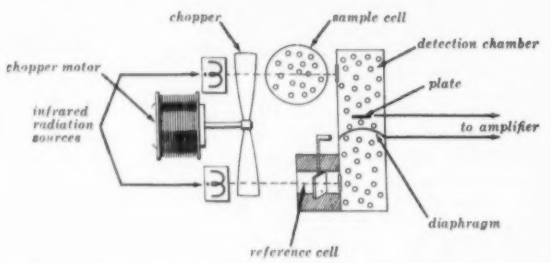
CIRCLE 14 ON READER-SERVICE CARD

Medical Gas Analyzer

The Beckman LB-1 Medical Gas Analyzer is a compact, portable instrument which continuously measures the concentration of a specific gas by infrared absorption.

The basic instrument consists of an amplifier with



direct-reading meter, and a pickup head containing the sample cell and infrared detection system . . .

Two identical infrared sources in the pickup head emit beams of radiation that are pulsed by a motor-driven chopper . . . When the gas being measured enters the sample cell, it absorbs infrared radiation at the same wave-lengths as the gas in the detection chamber. This reduces the amount of radiation reaching the gas in the sample side of the detection chamber and produces a lower pressure in that side . . . (*From new* 4-*page Bulletin S*-168, *Spinco Division, Beckman Instruments, Inc., Stanford Industrial Park, Palo Alto, Calif.*)

FOR THIS LITERATURE CIRCLE 86 ON READER-SERVICE CARD

NEW APPROACH TO BLOOD COAGULATION STUDIES

BENDIX LAB-VIS

Photograph of LAB-VIS and medical probe, showing how blood is introduced into cannula.

The Bendix LAB-VIS is a continuous recording viscometer which follows the instantaneous changes in the coagulation curve of blood. These viscosity curves have been successfully employed in studies of thromboembolism, myocardial infarction, phlebothrombosis, dicumarol therapy, carcinomatosis, abnormal bleeding. For complete information on the Bendix LAB-VIS, write . . .

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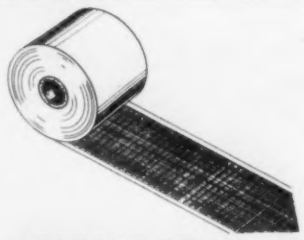
Canada: Computing Devices of Canada, Ltd., Box 508, Ottawa 4, Ont.

Bendix CORPORATION

CIRCLE 87 ON READER-SERVICE CARD



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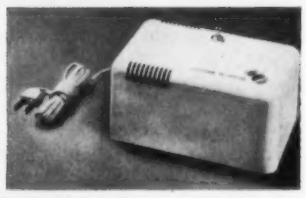
CIRCLE 15 ON READER-SERVICE CARD

HEARTBEAT SIMULATOR



New Securitone, intended to be placed next to a baby's bassinet or crib, reproduces the sound of a mother's hearbeat when plugged into any standard outlet. Hospital tests show that babies who hear the sounds cry less, sleep better and gain more weight, as the device gives them the security of a mother's heartbeat.—*Sonotone Corp., Elmsford, N. Y.*

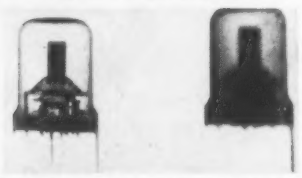
CIRCLE 88 ON READER-SERVICE CARD

CONTINUOUS-DUTY RECTIFIER

New Continuous Duty Rectifiers, RE-40 series, rated 50 to 100 kw, 250 vdc, feature silicon diode efficiency of over 90%; diode protection system of magnetic amplifier design or amp trap and fuse failure indication; voltage stabilization of ±5% (20% to full load); automatic unit shut down upon abnormal diode failure or similar conditions. etc.—*Rapid Electric Co.*, 2881 *Middletown Rd., New York* 61, *N. Y.*

CIRCLE 89 ON READER-SERVICE CARD

IMAGE MAGNIFIER

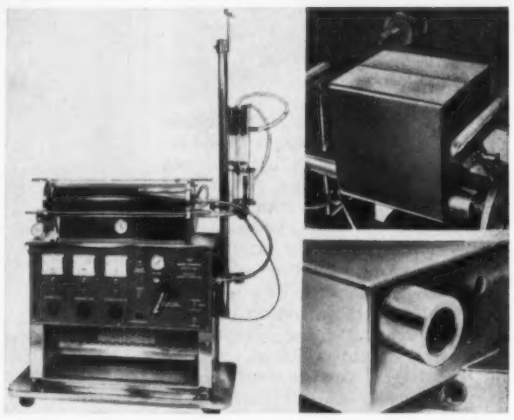


New X-ray Image Amplifying Technique, called "Super Magnification," increases by five times the previous limits of effective fluoroscopic magnification and yields a clearer picture 20-times original size on a television monitor or screen. Images are produced more than 1,000 times brighter than a standard fluoroscopic screen. —*Picker X-Ray Corp., subs. of C.I.T. Financial Corp.*, 25 *S. Broadway, White Plaines, N. Y.*

CIRCLE 90 ON READER-SERVICE CARD

Safer Heart-Lung Machine

HINGHAM, MASS.—Conventional welding techniques for joining stainless-steel components in artificial heart-lung machines are unsatisfactory because of ever present microscopic cracks in the joint area. This necessitated excessive grinding and polishing to achieve the almost perfect finish required on this equipment.



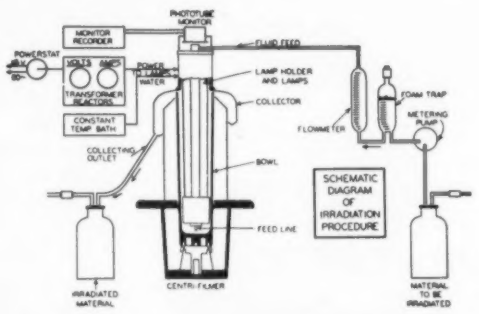
High Vacuum Equipment Corp. of Hingham, Mass., through its subsidiary Kinetics Corp., and the Mark Co., a division of Image Transfer Inc., producers of the machine, have joined forces to apply a new brazing technique. Evolved by Kinetics Corp., this technique uses a filler metal, primarily composed of nickel, which is preplaced in the joint area before brazing in a vacuum furnace at temperatures of 1800 to 2200°F. Skillful polishing of the finished product produces a homogenous appearance, inasmuch as the brazing metal approximates the color of stainless steel. This technique eliminates all possibilities of the presence of toxic constituents which can creep in by low-temperature braze filler metals and fluxes.

CIRCLE 91 ON READER-SERVICE CARD

Safety Through Irradiation

Parke, Davis & Company pioneered in the use of ultraviolet irradition as a procedure to insure safety of several virus vaccines.

The source of ultraviolet rays is the Michael Reese Centrifugal Filmer developed in cooperation with Parke, Davis & Co. and engineered by General Motors' Special Problems Department. The primary component of the Filmer is a vertical 15″ stainless steel bowl, which rotates at a fixed speed of 1750 rpm . . . In operation, six are suspended inside the rotating



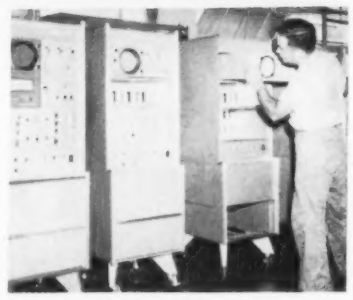
bowl, so that an area of approximately 750 square centimeters on the inner surface of the bowl with its flowing thin film of fluid receives incident ultraviolet energy of controllable intensity . . . As Stimpert, McLean, and Wilner point out, "In all probability the mechanism of inactivation by ultraviolet involves alteration in some degree of the organization within the virus particle, and is quite different in mechanics from formaldehyde inactivation" . . . Since October, 1955, all poliomyelitis vaccine manufactured by Parke, Davis & Co. has been prepared by the combination-inactivation process . . . (*From new 72-page booklet "Biological Products," Parke, Davis & Co., Detroit* 32, *Mich.*)

FOR THIS LITERATURE CIRCLE 92 ON READER-SERVICE CARD

ARMOUR RESEARCH FOUNDATION has developed a console-mounted package of clinical instruments to record heart sound, heart rate, blood pressure, respiration rate, make a continuous electrocardiogram, and to register blood oxygen content, and galvanic skin response. These measurements will furnish indications of bodily responses of a pilot during vertical motion tests which simulate actual conditions such as re-entry from space.

GENERAL ELECTRIC CO.'s Communication Products Department solved the problem of shielding therapy technicians from an overdose of x-rays emitted by an x-ray therapy machine installed behind a wall, and yet being able to observe the patient. A closed-circuit TV monitor was set up in an adjoining control room.

FETAL MONITOR



New Fetal Monitor continuously recording the fetal heart beat, clearly and distinct from that of the maternal heart beat provides warning to aid in the detection of fetal distress, which may lead to neurological damage. The monitor also supplies the obstetrician with information regarding uterine contractions.—*Epsco Incorporated*, 275 *Massachusetts Ave., Cambridge, Mass.*

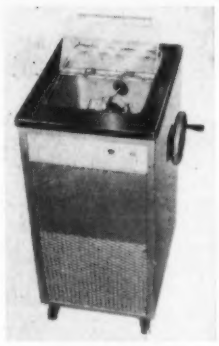
CIRCLE 93 ON READER-SERVICE CARD

INFRARED SCANNING SYSTEM

New infrared Thermopan Scanning System which allows remote and rapid scanning of an extensive area of the skin and presents a visual image of the observed temperature pattern, consists of a scanning section, a radiometer, and a display. Scan pattern can be reproduced on a standard cathode ray tube or storage tube display. The radiometer measures infrared radiation emitted by the scanned surface. Output signal of infrared detector causes a lamp to brighten and a whiter spot appears on Polaroid film. Sensitivity of the technique is such that thermogram shows white spots in a face where temperature is 2°C higher than in spots represented in black. Using an infrared detector at the dry ice point or liquid nitrogen, temperature differentials of 0.1°C are readily detected and recorded on Polaroid film.—*Radiation Electronics Co., Div. of Comptometer Corp.*, 5600 *Jarvis Ave., Chicago* 48, *Ill.*

CIRCLE 94 ON READER-SERVICE CARD

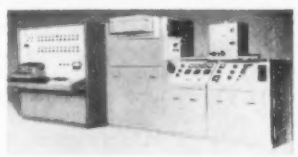
MICROTOME-CRYOSTAT



New Cryostat Model CT, cuts single or multiple sections of fresh frozen tissue samples. Sample to be sectioned is quick-frozen on the microtome specimen holder by means of a CO_2 quick freeze attachment. The specimen and holder are then mounted on the microtome and the operator is ready to cut sections.—*International Equipment Co.*, 1284 *Soldiers Field Rd., Boston* 35, *Mass.*

CIRCLE 95 ON READER-SERVICE CARD

SPECTROMETER PRINT-OUT



New Typewriter Print-Out System for direct-reading spectrometers records data and prints a number proportional to percent concentration of the chemical elements present in the sample.—*Jarrell-Ash Co.*, 26 *Farwell St., Newtonville* 60, *Mass.*

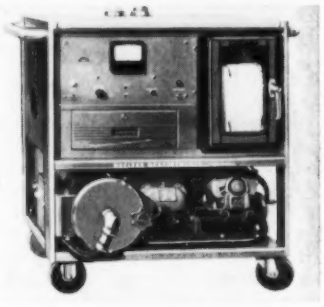
CIRCLE 96 ON READER-SERVICE CARD

RESPIRATION AID

New Anesthalung is a small self-contained oxygen-powered unit. Weighing 13 lb it can be attached to any standard anesthetic machine or mounted in an anesthetic cylinder yoke. It incorporates a pressure-sensitive volume control of extremely low resistance so that little inspiration or expiration pressure is required by the patient. The unit does not interfere with the patient's effort to breathe spontaneously, and the patient can over-ride the system at any time.—*National Cylinder Gas Div., Chemetron Corp.*, 840 *N. Michigan Ave., Chicago* 11, *Ill.*

CIRCLE 97 ON READER-SERVICE CARD

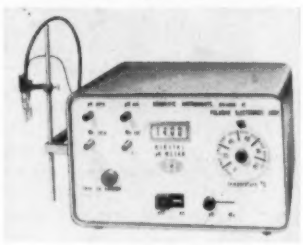
IODINE VAPOR AIR MONITOR



New Air Monitor, Model AM-2S, detects radiation in airborne iodine vapors. It measures and records the amount of specific gamma activity by depositing vapors on an activated carbon filter. Energy range is 0.33 to 0.55 mev.—*Nuclear Measurements Corp.*, 2460 *N. Arlington Ave., Indianapolis* 18, *Ind.*

CIRCLE 98 ON READER-SERVICE CARD

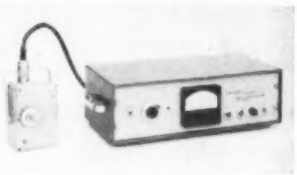
DIGITAL pH METER



New automatic Self-balancing pH Meter is line operated and provides a four-digit readout. Line fluctuations of up to 10% do not affect the instrument's accuracy. Includes millivolt scale for redox reactions and recorder plug-in. Accuracy is 0.02 pH units covering full range of 0 to 14.00 pH units.—*Polarad Electronics Corp.*, 43-20 34*th St., Long Island City*, 1, *N. Y.*

CIRCLE 99 ON READER-SERVICE CARD

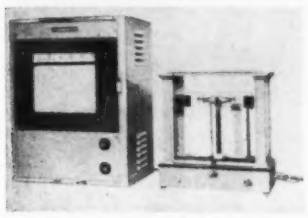
MEDICAL GAS ANALYZER



New Model LB-1 Medical Gas Analyzer measures concentration of medical gas continuously with response time of 0.1 second to 90% full scale. Complete instrument consists of amplifier, pickup head, breathe-through sample cell, microcatheter sample cell, microcatheter sample pump and flow meter, with one sample cell installed in pickup head. Also includes input cable and connectors, low and high impedance recorder output cables, hand pump for pressurizing pickup head.—*Spinco Div., Beckman Instruments, Inc., Stanford Industrial Park, Palo Alto, Calif.*

CIRCLE 100 ON READER-SERVICE CARD

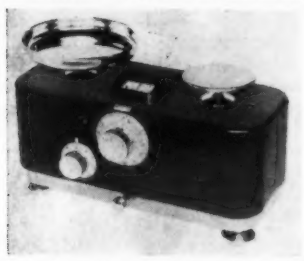
RECORDING ANALYTICAL BALANCE



This instrument combines the range and accuracy of the analytical balance with a continuous record and automatic operation. It shows both instantaneous weight and rate of change. Weight changes occurring while the sample is in the balance, or suspended outside the balance in an oven, furnace, special atmosphere, or other controlled environment can be recorded continuously for short or long periods. Uses include thermogravimetric analysis, studies of evaporation, oxidation, sublimation, decomposition, absorption, sedimentation, or simply drying to constant weight. —*Wm. Ainsworth & Sons, Inc.*, 2151 *Lawrence St., Denver* 5, *Colo.*

CIRCLE 101 ON READER-SERVICE CARD

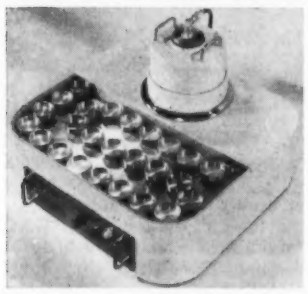
500-GRAM TORSION BALANCE



New two-dial oil-damped Balance, Model DWL-5, manufactured by the Torsion Balance Company, Clifton, N. J., allows dialing up to 90 grams of weight loading by 10-gram increments with one hand. The fine-weighing dial then adds up to 10 grams more by one-tenth gram graduations. Accuracy is 50 milligrams.—*Torsion Balance Co., Clifton, N. J.*

CIRCLE 102 ON READER-SERVICE CARD

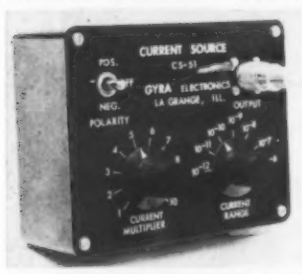
AUTOMATIC SAMPLE CHANGER



New SC-100 MULTI-MATIC Sample Changer accommodates fifty samples—alpha, beta, or gamma emmitters—of any size up to 2" in a wide variety of sample counting modes and sizes. Operates with all types of detectors: G-M, proportional (tube or flow types), and scintillation. Operation is simple: Single knob control allows automatic recycling of a single sample, bypassing of empty sample positions, recycling to the starting position, or programming samples for any number of cycles, etc.—*Tracerlab*, 1601 *Trapelo Rd., Waltham* 54, *Mass.*

CIRCLE 103 ON READER-SERVICE CARD

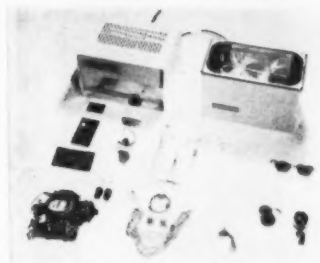
PORTABLE CURRENT SOURCE



New Current Source, Model CS-51, is a portable, battery operated supply of current which, when attached to the input of an electrometer, allows the user to check the accuracy of the ranges, heat damage to the resistors, and subsequent change in value, as well as a ready check of the entire circuit for accuracy. Details in bulletin. —*Gyra Electronics Corp., Washington & Elm St., Box* 184, *La Grange, Ill.*

CIRCLE 104 ON READER-SERVICE CARD

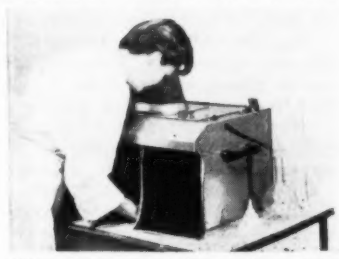
ULTRASONIC CLEANER



New diSONtegrator System Eighty, a 1½-gallon capacity Ultrasonic Cleaner, features a broad-band frequency-modulated circuit which eliminates the need for automatic tuning as found in much higher priced equipment. The generator is rated at 120 w average power, 480 w peak power output. Disintegrates more than fifty distinct classes of soils and contaminants. Especially suited for surgical instruments.—*Ultrasonic Industries, Ames Court, Engineers Hill, Plainview, L. I., N. Y.*

CIRCLE 105 ON READER-SERVICE CARD

PORTABLE ANALYSIS CABINET



New Chromato-Vue, self-contained portable Viewing Cabinet for examining fluorescent chromatograms, equipped with high-output sources of shortwave ultraviolet (2537 a.u.) and longwave ultraviolet (3660 a.u.) as well as white light, uses for all five observation techniques of ultra-violet paper chromatography; direct light fluorescence; direct light absorption; transmitted light absorption; transmitted light absorption intensified with fluorescent screen and permanent record by transmitted light. Details in bulletin.—*Black Light Eastern Corp., 4 Manhasset Ave., Port Washington, L. I., N. Y.*

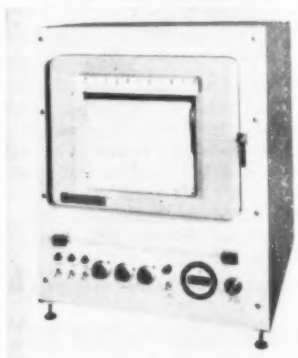
CIRCLE 106 ON READER-SERVICE CARD

STEREOMICROSCOPE

New Type M-5 Stereomicroscope provides uniform, maximum sharpness throughout the field without change in accommodation, and features interpupillary distance scale. Standard magnifications are 6x, 12x, 25x, and 50x.—*Wild Heerbrugg Instruments, Inc., Main and Covert Sts., Port Washington, L. I., N. Y.*

CIRCLE 107 ON READER-SERVICE CARD

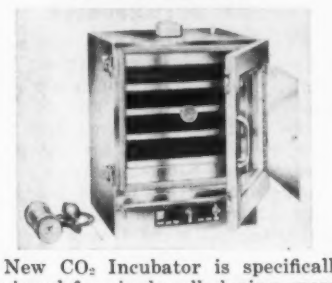
FLOW PHOTOMETER



New Recording Flow Photometer which provides simultaneous photometric readings of a sample stream through 3 different light channels is directly applicable to automatic amino acid analysis, also to analysis and control of effluents from chromatography columns and of many continuous flow production processes. Details in RSC Review, Vol. 2, No. 3—*Research Specialties, Co.*, 200 *South Garrand Blvd., Richmond, Calif.*

CIRCLE 108 ON READER-SERVICE CARD

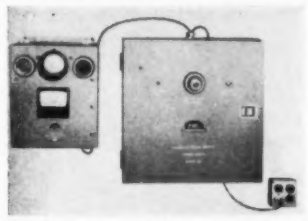
CO_2 INCUBATOR



New CO_2 Incubator is specifically designed for single-cell cloning operations and routine maintenance of mammalian tissue cultures in an appropriate CO_2 atmosphere. Humidity is provided by bubbling the CO_2-air mixture through a moisturizing flask. Working chamber measures 13" wide x 11⅞" deep x 11¾" high.—*Labline, Inc.*, 3070 *W. Grand Ave., Chicago* 22, *Ill.*

CIRCLE 109 ON READER-SERVICE CARD

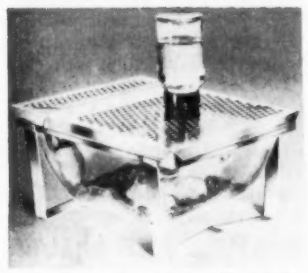
AUXILIARY POWER SUPPLY



New auxiliary Power Supply, Model PSA-11, a wet-cell system with built-in battery charger, supplies auxiliary power to the GA-2 gamma radiation area monitor in the event of failure in the primary 110-v source. —*Nuclear Measurements Corp.*, 2460 *N. Arlington Ave., Indianapolis* 18, *Ind.*

CIRCLE 110 ON READER-SERVICE CARD

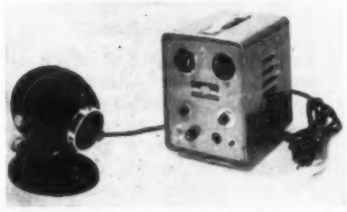
MOUSE CAGE SUPPORTS



New Cleer-Vue Cage Supports for disposable plastic mouse cages, measuring 10½" x 8¼" x 5" effectively support the cages in suspended fashion without obstructing view of the contents.—*Disposable Laboratory Cages, Inc.*, 3070 *W. Grand Ave., Chicago* 22, *Ill.*

CIRCLE 111 ON READER-SERVICE CARD

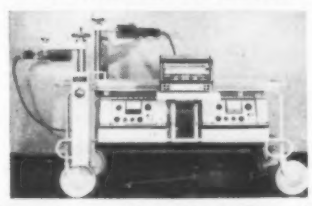
FLASH ILLUMINATOR



New electronic Flash Illuminator uses a small xenon-filled flash lamp for applications ranging from photography of blood vessels in the white of the eye to photography of insects. Specifications and details are contained in Data Sheet 5000.—*Edgerton, Germeshausen & Grier, Inc.*, 160 *Brookline Ave., Boston* 15, *Mass.*

CIRCLE 112 ON READER-SERVICE CARD

MYOCARDIAL DIAGNOSIS



New Myocardial Blood Flow System helps predict heart attacks by evaluation of blood flow record. System consists of scintillation detector, ratemeter and recorder, furnishing a graph of blood flow. Coronary blood flow, in contrast to total blood flow through heart, shows up on record and can be evaluated.—*Tracerlab Inc.*, 1601 *Trapelo Rd., Waltham* 54, *Mass.*

CIRCLE 113 ON READER-SERVICE CARD

TRI-R *Electronic* THERMOMETER

THERMISTOR TYPE

- ***RAPID*** . . . Read temperature in seconds
- ***ACCURATE*** . . . ±½% of scale range
- ***RANGES*** . . . From −35 to +150°C.
- ***DIRECT READING*** . . . In °C. and °F.
- ***REMOTE READING*** . . . Leads to 1000 feet
- ***LOW COST*** . . . Priced from $72.00
- ***STABLE*** . . . Mercury cell battery models, regulated line operated models
- ***PROBES*** . . . Interchangeable and special for human, animal, laboratory use

For Thermometer bulletin write Dept. M-3

TRI-R INSTRUMENTS

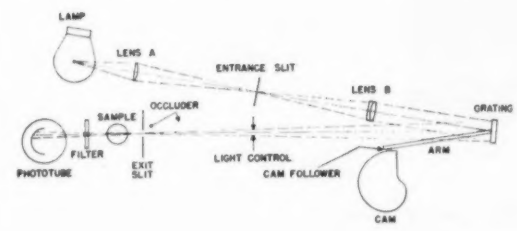
Developers of Electronic and Mechanical Instruments for Scientific Research

144-13 JAMAICA AVENUE, JAMAICA 35, N. Y.

CIRCLE 16 ON READER-SERVICE CARD

Spectronic Analyzers

Colorimetry and Spectrophotometry will be taken care of by this ultra-modern instrument. In clinical and pathological laboratories; industrial and food laboratories; colleges and universities; water and stream pollution control projects; public health and general biochemical laboratories . . . The Bausch & Lomb Certified-Precision Diffraction Grating, 600 grooves per mm, eliminates filters throughout the 375-650 mμ range, and to 950 mμ with a quick change



of phototube and supplementary infra-red transmitting filter . . . In *Colorimetry*, quick, easy readings in optical density or percent transmittance are taken direct from the scale. Straighter, steeper plots are obtained, where Beer's law applies, because of the narrow band pass and absence of stray light . . . In *Spectrophotometry*, the certified-precision diffraction grating pinpoints absorption measurements between quickly selected settings of the wavelength selector knob . . . You can run assays for Serum Glutamic-Oxalacetic Transaminase in one-sixth the time of other methods —if you can make photometric readings at 340 mμ. (Karmen, A . . . *J. Clin. Invest* 34, 131-33; 1955.) That means the only colorimeter that can do it is a B&L Spectronic 20 . . . (*From new* 8-*page Catalog D-266. Bausch & Lomb Optical Co.*, 60245 *St. Paul St., Rochester* 2, *N. Y.*)

FOR THIS LITERATURE CIRCLE 114 ON READER-SERVICE CARD

Micro-Min Response Sensor

WASHINGTON, D. C.—At a recent meeting of the American Rocket Society, Douglas Aircraft Co. (Santa Monica, Calif.) displayed some "mini-sensors," miniaturized electronic primary elements to measure physical and physiological responses of pilots.

Such a device, no bigger than a nickel, can measure heart beat and transmit data to a remote receiver some 50 ft away. These data, retransmitted by the receiver, make ground evaluation possible. Computer-processing is presently under development.

The need for miniaturization became apparent when it was discovered that pilots' reactions sometimes were influenced by irritations arising from wearing bulky harnesses, wiring and relatively large sensing equipment.

For more data about products advertised or described, circle pertinent numbers on reply card.

MEDICAL ELECTRONICS BITS

STROMBERG-CARLSON DIV. of General Dynamics announces that *Dr. Curt F. Fey* has joined the division as a mathematical psychologist.

TECHNICON CONTROLS announces establishment of a world-wide sales organization with principal offices on every continent to represent Technicon's line of industrial and medical analytical equipment.

NEW YORK ACADEMY OF SCIENCES announces new officers: *Dr. Frederick Y. Wiselogle*, associate director in charge of Chemical Research, Squibb Institute for Medical Research, has become president; *Dr. James B. Allison*, professor of Physiology and Biochemistry, Rutgers University, has been elected president-elect; and *Dr. Ross F. Nigrelli*, pathologist, New York City Aquarium, has been elected corresponding secretary.

STARLING CORP., 2047 Sawtelle Blvd., West Los Angeles, Calif., has been formed to produce and market the "Fox Glove" system applying the digital computer to medicine, displaying pressure, temperature, respiration, etc. in a patient in surgery or under observation.

BENDIX CORP. announces an agreement with **WILMOT CASTLE CO.** of Rochester for sales and distribution of the Bendix line of sonic-energy cleaning systems for hospital application.

INDUSTRIAL INSTRUMENTS, INC. has purchased the assets of *Critical Measurements Inc.*, and will manufacture and sell the Blood Loss Monitor through its Critical Measurements Division.

SPACELABS, INC. announces appointment of *George H. Sullivan*, M. D., as medical director.

SHAMPAINE INDUSTRIES has appointed *John B. Dunne* manager, Therapeutic Products.

GEN. OMAR BRADLEY, board chairman of *Bulova Watch Co., Inc.*, has been elected chairman of the Eleanor Roosevelt Institute for Cancer Research.

DYNAMIC SCIENCE CORP., South Pasadena, Calif., a subsidiary of Marshall Industries has set up a new medical sciences department to conduct a research program in medical instrumentation, basic medicine and space medicine.

ISA, the Instrument Society of America, at its January conference and Exhibit in St. Louis held sessions on biomedical instrumentation at which several papers on the subject were read.

SOUTHEASTERN SIMULATION COUNCIL focused attention on data-processing devices in medical research in a paper read at its January meeting in Atlanta.

FAA, the Federal Aviation Agency, has established an 11-man Medical Advisory Council consisting of physicians prominent in aviation medicine.

NEW YORK ACADEMY OF SCIENCES recently held a conference on current problems in electrobiology.

ITT, in behalf of the Cuban Telephone Co., a former ITT subsidiary, presented a check for $40,000 to the University of Miami School of Medicine to underwrite a three-month postgraduate training course for about 300 Cuban physicians in exile in the Miami area. Among them are 22 full professors from the School of Medicine of the University of Havana. They all have been given Visiting Professorships at the Miami School.

At **UNIVERSITY OF ARIZONA** *Dr. Kenneth F. Wertman*, head of the Department of Bacteriology and Medical Technology, and *Dr. Irvin Yall*, associate professor of bacteriology have been studying rickettsiae, microorganisms larger than virus and smaller than bacteria. Radioactive materials are used to trace what life-giving substances the parasite takes from the host cell.

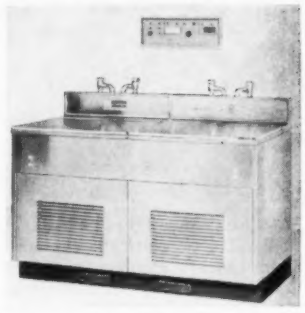
SHAMPAINE INDUSTRIES announces that the *O.E.M. Division*, now located in East Norwalk, Conn., will move in the near future to Shampaine's Roselle, N. J. works.

BLOOD VISCOSITY BY ULTRASONICS

New LAB-VIS uses ultrasonic waves to measure viscosity of Newtonian liquids continuously and automatically. Comprises an ultrasonic probe and an electronic automatic computer. Technique for continuous measurement of viscosity of blood during coagulation makes it possible to establish a mean curve to distinguish normal blood from "bleeders." Studies on thromboembolism, heparin administration, pseudo-hemophilia and the effects of stress on psychotics and non-psychotics have been undertaken. Other investigations are looking into relationship to phlebothrombosis, myocardial infarction, dicumarol therapy, carcinomatosis, pregnancy, in pre- and postoperative periods, and in patients with abnormal bleeding tendencies.—*Bendix Corp., Cincinnati Div., 3130 Wasson Rd., Cincinnati 8, Ohio.*

CIRCLE 116 ON READER-SERVICE CARD

SONIC ENERGY UNIT



New Console for hospital sonic energy systems is said to be the first such unit engineered exclusively for hospital procedures. The two-compartment unit incorporates a sonic bath and a rinse or rinse dry compartment. A distilled water rinse may be made a part of the cycle. Sonic energy for the cleaning bath is furnished by a bank of magnetostrictive transducers integrally welded to the bath chamber. An electronic control panel can be mounted above the unit or at a remote central station. Details in Brochure TC.—*American Sterilizer Co., Erie, Pa.*

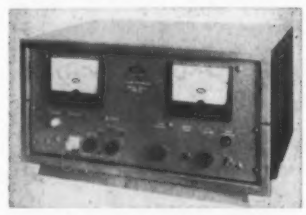
CIRCLE 117 ON READER-SERVICE CARD

PARTICLE SIZE ANALYZER

New Model PC200A Royco Particle Counter monitors atmospheres of clean rooms, etc., displays (on decade counters) numbers of particles present in 15 sub-ranges of sizes from 0.32 to 8.0 microns dia, or records on digital tape and/or strip-chart recorder. Automatic programming permits 0.3, 1, 3, or 10 minutes of monitoring on any or all sub-ranges in sequence. —*Royco Instruments Inc., 440 Olive St., Palo Alto, Calif.*

CIRCLE 118 ON READER-SERVICE CARD

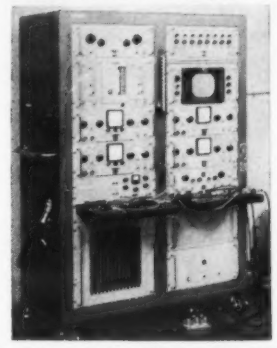
LINEAR COUNT RATEMETER



The CRM-11A measures any function which is characterized by varying flow rate, such as blood circulation. Diffusion of injected radioactive material may be traced and measured precisely using a G-M, scintillation or proportional counter detector, and can be recorded on either a 0-10 mv or 0-1 ma graphic recorder. Six counting ranges and five time constants may be selected by panel control. Accuracy is ±1% full scale reading.—*Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis 18, Ind.*

CIRCLE 119 ON READER-SERVICE CARD

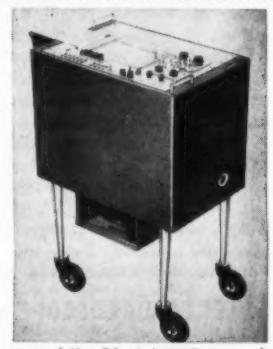
CARDIOVASCULAR EQUIPMENT



New line of Cardiovascular Equipment for precision physiological measurements features many combinations: For catheterization, the apparatus offers two to four simultaneous intracardiac pressures for right heart catheterization. Intracardiac electronic pressure transducers, plus intracardiac phonocardiography and blood sampling are available in one single catheter. Shown are four to eight channel oscilloscopes with high intensity trace for direct visualization of pressure curves, sound amplitude and frequency of murmurs, calibrated in mm Hg, plus extra channels for ECG, EEG or pneumograph. Four- to eight-channel photographic recorder with high frequency response employing fluid-damped mirror galvanometers, high-fidelity sound amplifiers and speakers are also available in a single or double rack combination suitable for all catheterization and surgical procedures.—*Dallons Laboratories, Inc., 5066 Santa Monica Blvd., Los Angeles 29, Calif.*

CIRCLE 120 ON READER-SERVICE CARD

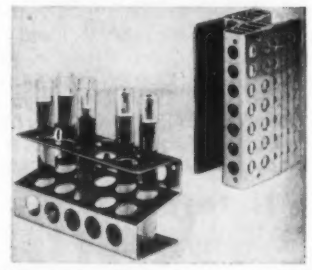
MOBILE OSCILLOGRAPH



New mobile Model 297 two-channel oscillograph uses plug-in interchangeable "850" style preamplifiers, is housed in 35" high wheel-mounted grey steel cabinet. Frequency response to 125 cps, within 3 db at 10-mm peak-to-peak amplitude; gain stability better than 1% over 20°C temp changes and 20-v power line variations; max non-linearity 0.25 mm.—*Sanborn Co., Industrial Div., 175 Wyman St., Waltham 54, Mass.*

CIRCLE 121 ON READER-SERVICE CARD

TEST-TUBE RACKS



New "Z-racks" made of heavy-gage stainless steel, have the advantage that their shape permits them to be nested inside each other to save bench and storage space. Available in 6", 10", and 12" lengths and in a wide variety of hole-sizes and arrangements.—*Massey Dickinson Co., Inc., Coker St. at Thayer Rd., Watertown 72, Mass.*

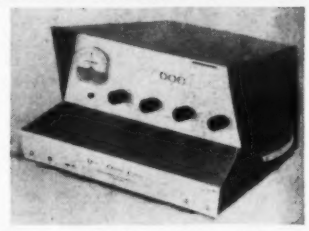
CIRCLE 122 ON READER-SERVICE CARD

VOLUMETRIC PISTON FILLER

New Accu Measure filler is made in single assembly units for bench filling or for mounting over intermittently operated chain conveyor for filling of Aerosol Cans. Each unit consists of a Stainless Steel Piston Assembly combined with an adjustable stroke air cylinder mounted directly above. Accurate control of liquid volume is easily secured by varying cylinder stroke.—*Scientific Filter Co., 57 Rose St., New York 38, N. Y.*

CIRCLE 123 ON READER-SERVICE CARD

DATA OPTIMIZING COMPUTER



New special-purpose laboratory computer, Model DOC 190, automatically changes the output of an electrical device to that which would be ordinarily obtained through the use of a calibration curve. Calibration curve information can be changed very quickly which makes it applicable with many instruments having different calibration curves. Output is the corrected or optimized data. —*Custom Engrg. & Devel. Co., 2647-49 Locust St., St. Louis 3, Mo.*

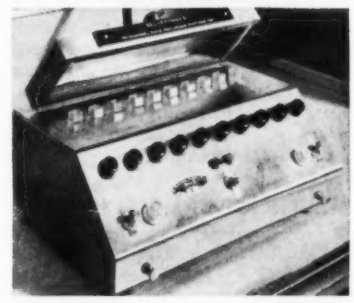
CIRCLE 124 ON READER-SERVICE CARD

CLINICAL PHOTOMETER

New Model M Photrometer (extra r) tests blood, serum, urine, spinal fluid, and other body fluids, applying certain optical laws. Cuvette holder accommodates three sizes, including those for minimum volume of less than 1 ml of colored solutions, making the Leitz Photrometer also suitable for tests on children and infants. A new micro ammeter provides a 30% longer scale for easier reading. Service, calibrating each instrument individually for forty of the most commonly made determinations, is offered.—*E. Leitz, Inc., 468 Park Ave., South, New York 16, N. Y.*

CIRCLE 125 ON READER-SERVICE CARD

RATE-RECORDING PHOTOMETER



New Rate Recording Photometer for automatic read-out of Protein Bound Iodine Determinations using the ceric-arsenite system, records the rate of change of transmittance which indicates the iodine concentration in ten different samples (knowns and unknowns) simultaneously.—*Microchemical Specialties Co., Berkeley 10, Calif.*

CIRCLE 126 ON READER-SERVICE CARD

BLOOD VOLUME

New Volemetron provides an almost automatic means of measuring a clinical patients blood volume by using a weak radioactive dose injected into the circulatory system.—*Atomium Corp., 940 Main St., Waltham, Mass.*

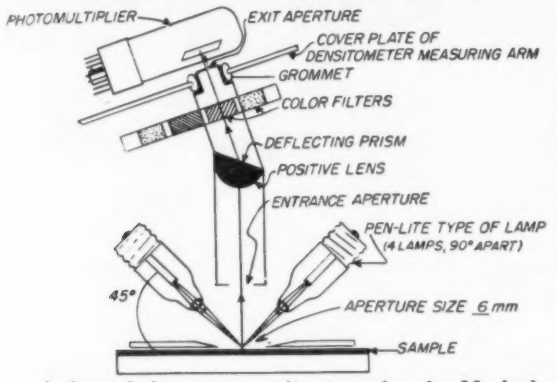
CIRCLE 127 ON READER-SERVICE CARD

EYE MOVEMENT CAMERA

New Eye Movement Camera consists of an optical system that transmits corneal reflection, plus what the observer sees, to a motor-driven 8-mm movie camera. Superimposed on the picture is a white dot showing the eyes' exact center of attention.—*Westgate Laboratory, Inc., P.O. 63, Yellow Springs, Ohio.*

CIRCLE 128 ON READER-SERVICE CARD

Electronic Densitometer

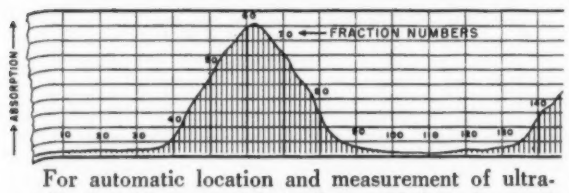


A few of the many applications for the Macbeth-Ansco Model 12A Densitometer: Transmission density measurements of tissue stains in the medical field; paper chromatography; electrophoresis; transmission density measurements of glass and other transparent films; transmission density measurements of liquid samples; atmosphere and haze measurements; etc.

The basic operating principle of the photomultiplier dynode feedback circuit is relatively simple. When a given specimen density is inserted in the light beam the photo multiplier tube output current is at first reduced but is then restored to its original value by increasing the dynode voltage. A voltmeter which responds to the dynode voltage applied to the tube necessary to restore the loss of output current for a given density specimen can be calibrated in terms of an optical density scale. The relationship between log sensitivity of the photomultiplier tube and dynode voltage . . . (*From 7-page bulletin, Macbeth Instrument Corp., Newburgh, N. Y.*)

FOR THIS LITERATURE CIRCLE 129 ON READER-SERVICE CARD

U. V. Flow Analyzers



For automatic location and measurement of ultraviolet-absorbing materials in flow, with base line and full sensitivity maintained in the presence of U. V.-absorbing solvents. For use in column chromatography and other flow systems with . . . peptides, . . . hormones, steroids, vitamines, conjugated fatty acids . . .

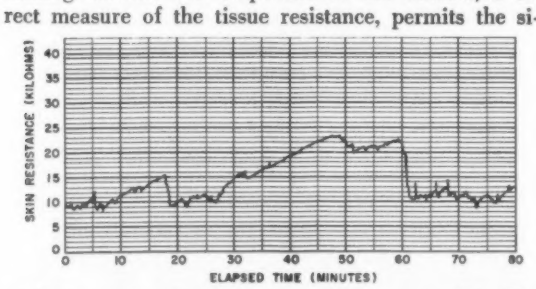
These instruments eliminate the large majority of these (spectrophotometric) analyses—by monitoring continuously during fraction collecting, and making available a running written record of the UV absorbing qualities of each collection tube . . . paper strip will tell you exactly which tubes have useful contents and which can be discarded . . .

Although models differ in detail, the general systems consists of a Double-Pass Monitor Head and a Master Ratio unit with Recorder. The Monitor Head houses a double photometric system . . . The Ratio Unit accepts two DC signals from the two phototubes, divides the solvent signal into the eluate signal, and feeds the quotient into the pen drive mechanism of the recorder . . . (*From new 4-page bulletin, Canal Industrial Corporation, 4940 St. Elmo Ave., Bethesda 14, Md.*)

FOR THIS LITERATURE CIRCLE 130 ON READER-SERVICE CARD

Tissue Resistance Monitor

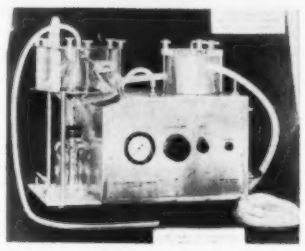
The Tissue Resistance Monitor uses a unique method for measuring tissue resistance independent of tissue potential, a source of ambiguity in many instruments. This device uses a low-frequency alternating sensing current. The amplitude of this current, a direct measure of the tissue resistance, permits the simultaneous monitoring of the tissue potential. The tissue potential is a DC measurement.



The phenomena of decreasing skin resistance caused by alertness, anxiety, and stress, and increasing skin resistance caused by drowsiness, sleep, and inattentiveness, are well established. Thus, the measurement of skin resistance is adaptable for aero and space monitoring, since skin resistance is one of the best indices of these various psychological states . . . (*From 4-page bulletin, Airborne Instruments Lab., Div. of Cutler-Hammer, Inc., Deer Park, L. I., N. Y.*)

FOR THIS LITERATURE CIRCLE 131 ON READER-SERVICE CARD

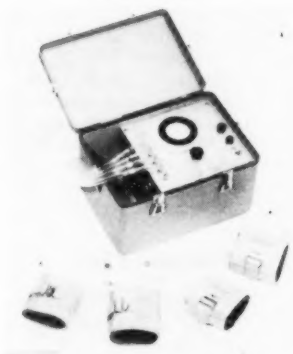
INTRACARDIAC SUCKER SYSTEM



New IBM-Mayo Intracardiac Sucker System provides efficient and atraumatic return of foamless intracardiac blood to any pump-oxygenator without the use of antifoam agents. System consists of a reservoir under negative pressure into which the blood is drawn from the sucker line; a dispersion cone located inside the reservoir over which the blood flows after entering; a mechanical level sensor which controls the pump; the pump which transports the blood from the reservoir to the pump-oxygenator; and a vacuum regulator and gages which controls the negative pressure in the reservoir.—*Custom Engrg. & Devel. Co., 2646-49 Locust St., St. Louis 3, Mo.*

CIRCLE 132 ON READER-SERVICE CARD

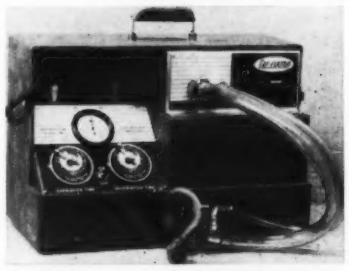
SEQUENTIAL OCCLUSION SYSTEM



New Sequential Occlusion System (S.O.S.), cardiac instrument, offers an automated means for emergency treatment of patients with congestive heart failure, by inhibiting the venous return and thereby pooling the blood in the extremities rather than in the lungs. Operates by a non-pulsating pump.—*Electro-Medical Engineering Co., 703 Main St., Burbank, Calif.*

CIRCLE 133 ON READER-SERVICE CARD

COFFLATOR



New improved Model 81 of the Cofflator stimulates the coughing function in those who have lost their cough reflex or who through paralysis are unable to rid themselves of secretions and mucus. Recommended for atelectasis, bronchial asthma, bronchiectasis, respiratory interruption, emphysema, poliomyelitis and cases of paralysis from brain stem damage. —*Shampaine Industries, Inc., O.E.M. Div., East Norwalk, Conn.*

CIRCLE 134 ON READER-SERVICE CARD

INFRARED SPECTROPHOTOMETER

New Model 221, a double beam, automatic-recording Spectrophotometer for qualitative and quantitative measurement of organic compounds, features programmed speed control and automatic gain control. Scans a spectral range from 1.0 to 15.5 microns with standard NaCl optics, and a range from 0.5 to 38 microns with other available prisms and interchange assemblies.—*Perkin-Elmer Corp., Norwalk, Conn.*

CIRCLE 135 ON READER-SERVICE CARD

First in Osmometry . . .

More laboratories have specified Osmometers from Advanced Instruments than from all other sources combined.

- Smaller, simplest
- 5-year refrigeration
- Stable probes
- Fully insulated
- Regional schools of osmometry
- Uniform 6-step instructions

Leader in Flame Photometry

- Smallest, simplest
- 1% precision
- 50 λ samples
- 13″ spread 120-140 Na+
- No electronics

The all new 1961 Laboratory Model 31L

ADVANCED INSTRUMENTS, INC.

53 Kenneth St., Newton Highlands 61, Mass. DEcatur 2-2600

CIRCLE 17 ON READER-SERVICE CARD

MED-TRONICS MFG. CO., INC. OF NEW YORK

RESEARCH — DESIGN — DEVELOPMENT

Med-Tronics, an organization highly skilled in electromechanics, is primarily engaged in design, development, and manufacture of high quality equipment for research institutions, laboratories, and corporations engaged in the Medical Electronic field.

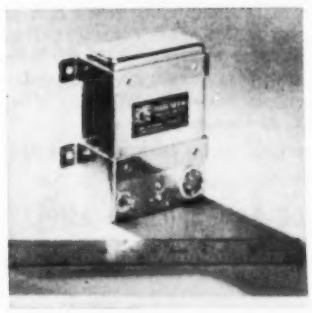
Med-Tronics is currently developing *new* electronic instrumentation in the following areas:

- **Laboratory Regulated Power Supplies—AC-DC.**
- **High Sensitivity Electronic Relays (Transistorized)**
- **Electronic Bacteria Counters**
- **Electronic, Electromechanical counting devices (to customers spec.)**
- **Behavior analysis apparatus (to customers spec.)**

Med-Tronics Mfg. Co., Inc. TA-4-2190 2019 Westchester Ave., N. Y. 62

CIRCLE 18 ON READER-SERVICE CARD

ELECTROCARDIOGRAPH AMPLIFIER



New T'elecardio is a miniture electrocardiograph transistorized amplifier (2½″ x 3½″) designed for amplifying minute electrical impulses generated by the human heart. Unit is operated from miniature batteries or from an external power supply.—*Taber Instrument Corp., 107 Goundry St., North Tonawanda, N. Y.*

CIRCLE 136 ON READER-SERVICE CARD

SPECTROPHOTOMETERS

New low-cost Infracord Spectrophotometers, are: the basic Model 137, which uses a double-beam, optical null system and provides a 12-min programmed scan of the fundamental 2.5-to-15-micron region, and the Model 137-G, a grating version, designed for high-resolution analyses in the near-infrared and adjacent infrared regions. Its overall range is 0.83 to 7.5 microns.—*Perkin-Elmer Corp., Norwalk, Conn.*

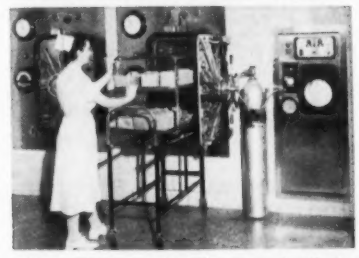
CIRCLE 137 ON READER-SERVICE CARD

TELEMETER TRANSMITTER

New micro-miniaturized Personalized Transmitting System which transmits over great distances physiological reactions of a pilot or astronaut, can also be used in hospitals and in medical and other research activities. Packaged in a flight helmet, three channels are available for brain emanations, heart-beat, and respiration of the subject. Reactions can be watched on the ground station recording devices. Details in Bulletin XP-BM-60.—*Vector Manufacturing Co., Inc., Southampton, Pa.*

CIRCLE 138 ON READER-SERVICE CARD

AUTOMATIC STERILIZER



New Sterox-O-Matic gas sterilizing equipment sterilizes finished packaged materials as well as heat and moisture sensitive products. Contents of pre-sealed plastic, paper or cardboard containers, such as rubber goods, adhesives, plastics, delicate instruments, catheters, and powders can be sterilized rapidly. Operation is completely automatic.—*Wilmot Castle Co., 1777 E. Henrietta Rd., Rochester, N. Y.*

CIRCLE 139 ON READER-SERVICE CARD

DIFFERENTIAL PREAMPLIFIER

New a-c coupled Differential Preamplifier Type LRA 042 with fixed gains of 10x, 100x, and 1000x has noise level of less than 10 μvolt peak to peak over a maximum bandwidth in excess of 60k. Common mode rejection of more than 100 db facilitates measurements in environments of strong interference. Input filter reduces TV pulse interference.—*Argonaut Associates Inc., P.O. Box 273, Beaverton, Ore.*

CIRCLE 140 ON READER-SERVICE CARD

STANDBY POWER UNITS

New Emergency Lighting and Power Units, which are completely automatic, are vitally needed for continuing surgical operations. They provide light within close to 1/20 sec after a power line failure. Bulletin gives details.—*American Television and Radio Co., 300 E. 4th St., St. Paul 1, Minn.*

CIRCLE 141 ON READER-SERVICE CARD

"OFF THE SHELF" *Low Cost Precision Components*

- Precision Potentiometers Single-turn Multi-turn
- Synchros
- Servo Motors
- Servo Motor Generators
- Tachometer Generators
- Gyros
- Servo Amplifiers
- Gears & Precision Gear Units
- Pressure Transducers
- "Servo-Kit"
- "Servo-Speed Torque-Unit"

Write for Free Catalog

THE
SERVO SYSTEMS CO.
14 Carmer Avenue Belleville 9, N. J.

CIRCLE 19 ON READER-SERVICE CARD

HIGH INTENSITY X-RAY GENERATOR

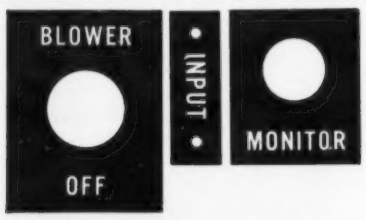
The Bracke-Seib X-Ray Co., Inc. Model 60-50-FW-IP x-ray generator produces high intensity soft x-rays for environmental or other studies requiring radiation in the range from 5 to 50 KV at intensities ranging to the order of 10^6 R/min. Water cooling of the x-ray tube and transformer unit permits continuous operation at maximum rating of 50 KV at 50 MA. The x-ray tube features a low absorption Beryllium window and is available in a variety of target materials.

BRACKE-SEIB X-RAY CO., INC.
16 Pelham Bay Park West
Pelham Manor, N. Y.

CIRCLE 20 ON READER-SERVICE CARD

ORGANIC MICROANALYSIS
H. W. Galbraith, Ph.D.
P.O. Box 4187 Knoxville 21, Tenn.
Founded 1950

CIRCLE 21 ON READER-SERVICE CARD



STOCK COLOR-ANODIZED NAME PLATES

DIVERSAL NAMEPLATE CO.
P.O. BOX 2337
SAN ANTONIO 6, TEXAS

CIRCLE 22 ON READER-SERVICE CARD

For Quiet and Continuous Service
SUCTION PRESSURE **PUMPS**

1—Diaphragm Ball Bearing Motor Capacities 20-30 lbs. P-S-I Airflow 8 Ltrs. Per Minute, Weight 7 Lbs.
2—Motorless, Completely Silent, Generates No Heat. Capacities 8 Lbs. P-S-I Airflow 3 Ltrs. Per Minute Weight 5½ Lbs.

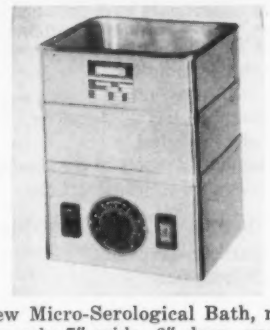
Ideal For Instrument Manufacturers Who Use Pumps in Their Equipment
WRITE FOR LITERATURE
NATIONAL MEDICAL PUMPS
Box 238, Boonton, N. J.
DE4-3438

CIRCLE 23 ON READER-SERVICE CARD

ELECTROPHORESIS
Do it your self kit
This unit can be assembled in one hour. Both the electrical power supply and tank are all included with easy to follow instructions for assembling and operating the unit. Here is an opportunity for every laboratory to start doing protein and hemoglobin fractions at a price ALL CAN AFFORD.
complete kit $30.00
Saylesville Clinical Laboratory
15 Roosevelt Ave., Lincoln, Rhode Island

CIRCLE 24 ON READER-SERVICE CARD

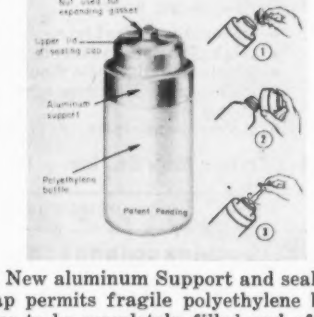
MICRO-SEROLOGICAL BATH



New Micro-Serological Bath, measuring only 7" wide, 6" deep, and 10" high, has a temperature range from 25°C to 100°C with a guaranteed uniformity of ±0.2°C or better. Originally conceived for blood pH, it has other medical, and resarch applications.—*Precision Scientific Co., 3737 West Cortland St., Chicago, Ill.*

CIRCLE 142 ON READER-SERVICE CARD

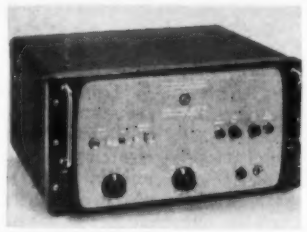
PLASTIC BOTTLE SUPPORT



New aluminum Support and sealing cap permits fragile polyethylene bottles to be completely filled and effectively sealed for centrifugation in angle-type superspeed centrifuges at forces up to 68,000 x G.—*Lourdes Instrument Corp., 656-676 Montauk Ave., Brooklyn 8, N. Y.*

CIRCLE 143 ON READER-SERVICE CARD

WIDE-BAND POWER AMPLIFIER



New Model DCA-50, a wide-band, low distortion, direct-coupled Power Amplifier delivers 50 volt-amp (110 volt-amp peaks) into a 330 ohm resistive or reactive load over the frequency range from dc to 250 kc and 100 w dc continuously. Over frequency range from 1 cps to 500 kc it delivers 50 w (100 w peaks) into a 200 ohm resistor load. Amplifier provides a choice of three voltage gains.—*Krohn-Hite Corp., Cambridge, Mass.*

CIRCLE 144 ON READER-SERVICE CARD

GAMMA SPECTROMETER

Model GSS-1 Gamma Spectrometer system is designed to eliminate the "dark current" defect. New system is a "sliding pulse" type wherein System is built around a combination linear count ratemeter and all-transistorized spectrometer circuit.—*Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis 18, Ind.*

CIRCLE 145 ON READER-SERVICE CARD

OZONE DETECTALARM

Ozone Detectalarm Model A.1 will automatically produce an alarm such as a light, buzzer, or bell and also actuate exhausting apparatus for the protection of personnel and materials whenever the ozone concentration of the surrounding atmosphere exceeds a preset level estimated to be dangerous. Concentrations of 10 phm are now detectalarmed in industrial and research service. Simultaneous recording is available.—*G. F. Bush Associates, Box 175, Princeton, N. J.*

CIRCLE 146 ON READER-SERVICE CARD

DOCTORS' RADIO

New line of low-priced lightweight, compact two-way radios for use by doctors, hospitals, and medical supply firms, the G-E Pacer, for operation in low band (27-50 mc) and high band (150-174 mc) has full-quality VHF-FM audio. 4¼" high, 7¾" wide and 12½" long. Fits under the dash of new small vehicles.—*General Electric, Communication Products Dept., Lynchburg, Va.*

CIRCLE 147 ON READER-SERVICE CARD

ARTIFICIAL MOUTH

New Artificial Mouth produces the same pattern of sound waves around a telephone as that produced when sound waves bounce back and forth between a telephone and a human face. Measurement techniques are sensitive enough to determine whether a person is wearing glasses when speaking on the telephone.—*International Telephone and Telegraph Corp., 67 Broad St., New York 4, N. Y.*

CIRCLE 148 ON READER-SERVICE CARD

AUDIOMETER

New T-2 Automatic Audiometer administers tests over a broad range of loudness levels and frequencies to groups of 10 or more persons, simultaneously screening persons who work in close proximity of jet aircraft, in missile operations, or in industrial jobs where high noise levels exist.—*Electro Nuclear Systems Corp., 4526 Excelsior Blvd., Minneapolis, Minn.*

CIRCLE 149 ON READER-SERVICE CARD

REFRIGERATED CENTRIFUGE

New refrigerated continuous-flow Centrifuge, Model 170, develops 28,000 G's at 18,750 rpm, with automatic temperature control of material. Rotor allows displacement volumes of either 100 or 400 ml.—*Spinco Div., Beckman Instruments, Inc., Stanford Industrial Park, Palo Alto, Calif.*

CIRCLE 150 ON READER-SERVICE CARD

WEDGE SPIROMETER

New high-dynamics Spirometer Model 170, provides simultaneous electrical output signals for volumes and flows, sufficiently large to drive standard recorders. Instrument is waterless but airtight. In spite of being driven by the patient's lungs it offers virtually zero resistance to breathing.—*Custom Engrg. & Devel. Co., 2647-49 Locust St., St. Louis 3, Mo.*

CIRCLE 151 ON READER-SERVICE CARD

Literature

FOR COPIES, CIRCLE NUMBER ON CARD.

ILLUMINATING DIAGNOSTIC INSTRUMENTS. 6-page folder illustrates and describes available models of various Coldlite diagnostic and operating instruments.—E. Miltenberg, Inc., 43 Great Jones St., New York 12, N. Y.

CIRCLE 152 ON READER-SERVICE CARD

ANALOG TAPE RECORDER. 4-page bulletin illustrates and describes features of Model M102 precision system used in electrocardiography, electroencephalography, etc.—Mnemotron Corp., One N. Main St., Spring Valley, N. Y.

CIRCLE 153 ON READER-SERVICE CARD

DEODORIZERS. 2-page Bulletin A-60 describes construction and application of electrostatic deodorizer for use in hospitals and laboratories.—Morris Deodorizers, Inc., 2819 Broadway NE, Knoxville 17, Tenn.

CIRCLE 154 ON READER-SERVICE CARD

THROMBOGRAPH. 8-page issue of the "Photocord," No. 2, describes several electronic instruments for the laboratory, including the Varicord, a bench-type recorder; a densitometer for checking performance of microfilm equipment; the Thrombograph for determination of clotting time; a reflection meter, etc.—Photovolt Corp., 95 Madison Ave., New York 16, N. Y.

CIRCLE 155 ON READER-SERVICE CARD

LABWARE. 40-page edition of the monthly S/P Review provides a resume of major equipment and supplies presented in past issues. Items featured include balances, centrifuges, recorders, microscopes, spectrophotometers, pH meters, glassware, membrane filters, plastic labware, etc.—Scientific Products, 1210 Leon Place, Evanston, Ill.

CIRCLE 156 ON READER-SERVICE CARD

PHYSICAL CHEMISTRY INSTRUMENTS. 6-page General Catalog illustrates and describes Ultraviolet Absorptiometer, Miniflow Precision Micropump, Column Electrophoresis Apparatus, Composite Column for Chromatography, Automatic Fraction Collector, Paper Electorphoresis Equipment, etc.—LKB Instruments, Inc., 4840 Rugby Ave., Washington 14, D. C.

CIRCLE 157 ON READER-SERVICE CARD

MEMBRANE FILTER. 3-page Manual 5, "Radiochemical Applications of the Membrane Filter" gives information on techniques useful in radiochemical application with 25 references.—Gelman Instrument Co., 106 North Main St., Chelsea, Mich.

CIRCLE 158 ON READER-SERVICE CARD

MEMBRANE FILTER. 6-page Manual 8 contains 141 references to unique uses of the membrane filter.—Gelman Instrument Co., 106 North Main St., Chelsea, Mich.

CIRCLE 159 ON READER-SERVICE CARD

PARTICLE SIZING. 2-page Manual 6, "Microscopic Methods for Particle Sizing" describes methods of determining particle sizes by using optical or electron microscopes.—Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.

CIRCLE 160 ON READER-SERVICE CARD

CARBON DIOXIDE INCUBATION. 18-page Bulletin 6051, describes the use of carbon dioxide and other oxygen-free atmospheres and the six incubator models available.—National Appliance Co., 7634 S. W. Capitol Highway, Portland, Ore.

CIRCLE 161 ON READER-SERVICE CARD

STEREOTAXIC INSTRUMENTS. 4-page Bulletin 5 illustrates and describes Model 4-C which permits research on small dogs, in addition to its regular uses on cats, monkeys and rats.—H. Neuman & Co., 8132 N. Lawndale Ave., Skokie, Ill.

CIRCLE 162 ON READER-SERVICE CARD

SURGICAL SCINTILLATION DETECTORS. 4-page DS8-1 Brochure describes in detail the new DS8-1 Scintillation Detector Set.—Nuclear-Chicago Corp., 359 East Howard Ave., Des Plaines, Ill.

CIRCLE 163 ON READER-SERVICE CARD

LABELED COMPOUNDS. 12-page Catalog 587 contains stock list of components labeled with radioactive and non-radioactive nuclides.—Nuclear Corp. of America, Box 688, 170 West Providence, Burbank, Calif.

CIRCLE 164 ON READER-SERVICE CARD

BIOLOGICAL PRODUCTS. 72-page booklet describes Vaccines, Toxoids, Immunogens, Antitoxins, and Diagnostic Agents.—Parke, Davis & Co., Detroit 32, Mich.

CIRCLE 165 ON READER-SERVICE CARD

BACTERIAL AIR SAMPLING. 4-page Manual 13 describes several methods of measuring airborne pathogens and lists references for further information.—Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.

CIRCLE 197 ON READER-SERVICE CARD

BASIC PHOTOMETER. 4-page Bulletin 297 describes the QuantaLog, a universal instrument for densitometry, photometery and colorimetry.—Macbeth Instrument Corp., Newburgh, N. Y.

CIRCLE 196 ON READER-SERVICE CARD

For more information on products shown, be sure to circle number on index card.

PRECISION CAMERA. 24-page Bulletin E gives descriptions and sample pictures taken with Sinar, an ultra-versatile precision camera used for photomicrography, etc.—Karl Heitz, Inc., 480 Lexington Ave., New York 17, N. Y.

CIRCLE 166 ON READER-SERVICE CARD

INTERCHANGEABLE VIEWCAMERA. 24-page booklet illustrates applications of Series SINAR interchangeable viewcamera (8x10, 5x7, 4x5, 2¼x3¼, 2¼x2¼) for macro- and microphotography, commercial and industrial photography, etc.—Karl Heitz, Inc., 480 Lexington Ave., New York 17, N. Y.

CIRCLE 167 ON READER-SERVICE CARD

AUTOMATIC AUDIOMETER. 2-page Bulletin ARJ-213 specifies with operational data Model ARJ-4 which prints hearing data on card.—Industrial Acoustics Co., Inc., 341 Jackson Ave., New York 54, N. Y.

CIRCLE 168 ON READER-SERVICE CARD

PAPER ELECTROPHORESIS. 8-page brochure describes application of a high-resolution buffer to the LKB Paper Electrophoresis Equipment.—LKB Instruments, Inc., 4840 Rugby Ave., Washington 14, D. C.

CIRCLE 169 ON READER-SERVICE CARD

BIOELECTRIC MONITOR. 2-page bulletin describes the B-30ATP Bio-pack, a self-contained package incorporating a subminiature transistorized differential amplifier and a companion FM transmitter.—Litton Systems, Inc., 5500 Canoga Ave., Woodland Hills, Calif.

CIRCLE 170 ON READER-SERVICE CARD

X-RAY PROTECTIVE MATERIALS. 36-page booklet contains details and specifications to serve basic needs for preparation of the best possible installation of x-ray shielding and other radiological protection.—Armeray Corp., X-Ray Protective Div., Kenvil, N. J.

CIRCLE 171 ON READER-SERVICE CARD

FLAME PHOTOMETER. 6-page brochure describes Model KY direct-reading, double-beam Flame Photometer having improved dielectric filter for determining K and Na in body fluids.—Baird-Atomic, Inc., 33 University Rd., Cambridge 38, Mass.

CIRCLE 172 ON READER-SERVICE CARD

PLASMA SPECTROGRAPH. 4-page bulletin describes research instrument for use in plasma diagnostics and high temperature gas research.—Spectrochemical Sales, Baird-Atomic, Inc., 33 University Rd., Cambridge 38, Mass.

CIRCLE 173 ON READER-SERVICE CARD

BLOOD pH. 2-page Bulletin 780 describes in detail the Micro Blood pH Assembly for pH measurement of blood or other body fluid.—Beckman Scientific and Process Instruments Div., 2500 Fullerton Rd., Fullerton, Calif.

CIRCLE 174 ON READER-SERVICE CARD

PYREX LABWARE. 12-page pocket-size folder illustrates and tabulates available glassware for biological studies.—Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago 22. Ill.

CIRCLE 175 ON READER-SERVICE CARD

ELECTROPHORESIS STRIPS. 32-page booklet describes and explains uses of Oxoid cellulose-acetate strips for electrophoresis.—Consolidated Labs., Inc., Chicago Heights, Ill.

CIRCLE 176 ON READER-SERVICE CARD

ELECTROPHORESIS APPARATUS. 16-page booklet contains full information on Shandon Universal Electrophoresis Apparatus (made in England).—Consolidated Labs., Inc., Chicago Heights, Ill.

CIRCLE 177 ON READER-SERVICE CARD

SIGNALING EQUIPMENT. 52-page Bulletin S-100 illustrates and describes Annunciators, Bells and Buzzers, Push Buttons, and other alarm equipment.—Edwards Co., Norwalk, Conn.

CIRCLE 178 ON READER-SERVICE CARD

TRACE ANALYSIS SERVICE. 4-page brochure "Tracing Traces" delineates an integrated trace analysis service.—Evans Research and Development Corp., 250 East 43rd St., New York 17, N. Y.

CIRCLE 179 ON READER-SERVICE CARD

BLOOD TRANSFER. 6-page folder illustrates and describes application of 4 types of plastic blood-transfusion units.—Fenwal Labs., Inc., Framingham, Mass.

CIRCLE 180 ON READER-SERVICE CARD

MEMBRANE FILTERS. 8-page brochure describes a new plastic filter material capable of removing submicron particles from fluids and gases.—Gelman Instrument Co., 106 North Main St., Chelsea, Mich.

CIRCLE 181 ON READER-SERVICE CARD

AIR SAMPLING. 44-page publication, "Dust Topics," Vol. 1, No. 2, describes new equipment for dust surveys, air pollution analysis, radiation protection, and special sub-micron filtration apparatus.—Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.

CIRCLE 182 ON READER-SERVICE CARD

LIFE SUPPORT SYSTEM FOR SPACE. 24-page booklet PIB-D-8 outlines projects including satellite aeromedical recovery vehicle, manned re-entry vehicles, food preservation systems for space flight, closed environmental systems for small primates, ecological systems, etc.—General Electric Co., Missile and Space Vehicle Dept., 3198 Chestnut St., Phila. 4, Pa.

CIRCLE 183 ON READER-SERVICE CARD

MICRO-MILL MIXERS. 2-page bulletin describes Eppenbach Micro-Mill, for rupturing microorganisms designed especially to disintegrate large quantities of slurries such as bacterial cells, spores, molds, yeast, and pollen granules.—Gifford Wood Co., Hudson, N. Y.

CIRCLE 184 ON READER-SERVICE CARD

WATER FILTRATION. 8-page Bulletin R-142 illustrates and describes construction and application of MIK filtration units.—Heico, Inc., Stroudsburg, Penna.

CIRCLE 185 ON READER-SERVICE CARD

HEART-LUNG UNITS. 8-page catalog illustrates and describes units and accessories for direct pumping from the patient.—Pemco Inc., 5663 Brecksville Rd., Cleveland 31, Ohio.

CIRCLE 186 ON READER-SERVICE CARD

CLOSED-CIRCUIT TV. 36-page catalog describes and illustrates systems, units and accessories of closed-circuit television, manufactured by E.M.I. Electronics Ltd. of Hayes, Middlesex, England.—Fairbanks, Morse & Co., Electronics Div., 505 Oakwood Ave., West Hartford 1, Conn.

CIRCLE 187 ON READER-SERVICE CARD

CARBON DIOXIDE SENSOR. 4-page Bulletin CS-60-1006 describes a Glass Electrode Carbon Dioxide Sensor for use in closed cycle rebreathing systems.—Beckman Instruments, Inc., Contract Sales Dept., 2500 Harbor Blvd., Fullerton, Calif.

CIRCLE 188 ON READER-SERVICE CARD

OXYGEN SENSOR. 4-page Bulletin CS-60-1005 describes and illustrates a polarographic Oxygen Sensor which can be used in applications where potential toxicity exists.—Beckman Instruments, Inc., Contract Sales Dept., 2500 Harbor Blvd., Fullerton, Calif.

CIRCLE 189 ON READER-SERVICE CARD

OPHTHALMIC CAMERA. 2-page color leaflet describes use of the ALPA 35-mm Single-lens Reflex camera and accessories for taking close-up photographs of the eye.—Karl Heitz Inc., 480 Lexington Ave., New York 17, N. Y.

CIRCLE 190 ON READER-SERVICE CARD

RADIATION DETECTION. 4-page Bulletin "The Fallout" puts the spotlight on an integrated monitoring system connected to a central control room panel, and describes other individual monitoring systems including a gamma alarm system, a new air monitor that detects activity in both iodine vapors and air-borne particulates, and a fluid monitor that handles gases and liquids. Also described is the GSS-1 gamma spectrometer.—Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis 18, Ind.

CIRCLE 191 ON READER-SERVICE CARD

BENZOIC ACID IN FLUIDS. 2-page data sheet presents a proposed methodology for continuous automatic determination of benzoic acid content of fluids. The chemical procedure is described in detail. A flow diagram of the analytical system is included.—Technicon Controls, Inc., Chauncey, N. Y.

CIRCLE 192 ON READER-SERVICE CARD

RECORDING FLUOROMETER. 2-page data sheet describes Model 111 Self-Balancing Fluorometer, which provides both direct readout and outputs for recorders or controllers.—G. K. Turner Assos., 2524 Pulgas Ave., Palo Alto, Calif.

CIRCLE 193 ON READER-SERVICE CARD

LINT-FREE UNIFORMS. New 1961 Catalog illustrates and describes lint-free, acid-resistant, and static-free lab coats, dresses, shoe covers, caps, gloves, etc. for men and women.—Worklon, Dept. 1-21, 253 West 28th St., New York 1, N. Y.

CIRCLE 194 ON READER-SERVICE CARD

DATA RECORDERS EXPENSIVE?

not any more!

MNEMOTRON model 204

Record/Reproduce System

complete with Tape Transport

Now you can afford the precision data recording facilities you need . . . as few as 2 channels, as many as 4, 6, 7 on ¼" tape; and 14 on ½" tape.

Mnemotron pioneers this *price-plus-precision* breakthrough with new recording and reproduction principles and highly developed transistorized circuitry.

Versatile, economical and portable, Mnemotron performs all these functions with exceptional precision: • Data acquisition, storage, analysis and reduction. • Time scale contraction and expansion. • Dynamic Simulation. • Programming. • Computer Read In and Read Out.

With Mnemotron, you can do more with your paper recorders, too . . . expanding frequency response and channel capacity, saving you from being "snowed" with data, letting you look at the same data at different time scales.

When the data you want is analog, record and reproduce it with greater accuracy and much lower cost with Mnemotron.

Write, wire, phone today for complete details on this new concept in instrumentation tape recording.

now . . . for general scientific, medical and biological research . . . a ***complete,*** *easy-to-use* ***4****-channel Analog tape system . . . only*

$2,950

with 0.2% precision

Also available:
Model 102A—2-channel system $1390

Model 204 features:

Any 2 of these speeds: 1⅞, 3¾, 7½, 15 ips

Frequency Response: DC-800 cps @ 15 ips; DC-400 cps @ 7½ ips

Linearity: 0.2% full scale

Noise: Less than −50 db full scale

Crosstalk: below 70 db

See us at the FEDERATION MEETING BOOTH 210

MNEMOTRON CORPORATION

1 North Main St., Spring Valley, N. Y. • Elmwood 6-6460 • Cables: Mnemotron

Precision Analog Data Tape Recorders and Biological Computers

CIRCLE 25 ON READER-SERVICE CARD

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INSTRUMENTATION NEEDED

Do you want help? Fill in the following, and your editors will try to help you!

1. What variables **can't** you measure satisfactorily? .....

..... In what application? .....

Units and range of measurement required: .....

Present technique being used: .....

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MEDICAL ELECTRONICS NEWS
845 Ridge Avenue, Pittsburgh 12, Pennsylvania

EVENTS

FOR MORE INFORMATION WRITE TO SOURCE MENTIONED.

April 5-7

Annual Meeting of the Institute of Environmental Sciences. Sheraton Park Hotel, Washington, D. C. For information write Institute of Environmental Sciences, Box 191, Mt. Prospect, Ill.

April 9-13

American Industrial Hygience Conference, Sheraton-Cadillac Hotel, Detroit, Mich. For information write AIHA, Executive Secretary, 14125 Prevost, Detroit 27, Mich.

April 10-14

Meeting and Exhibit Federation of American Societies for Experimental Biology, Convention Hall, Atlantic City, N. J. For information write William Andrews, 280 Madison Ave., New York 16, N. Y.

April 13-14

Symposium on Biomedical Engineering, San Diego, Calif. For information write John McLeod, American Institute of Electrical Engineers, 8484 La Jolla Shores Dr., La Jolla, Calif.

April 24-27

Annual Aerospace Medical Association Conference, Palmer House Hotel, Chicago, Ill. For information write James N. Waggoner, M. D., The Garrett Corp., 9851 Sepulveda Blvd., Los Angeles 45, Calif.

June 4-6

American Nuclear Society, Isotopes and Radiation Division, Meeting, Pittsburgh, Pa. For information write Executive Secretary, American Nuclear Society, 86 East Randolph St., Chicago 1, Ill.

June 11-15

Air Pollution Instrumentation Symposium, Hotel Commodore, New York, N. Y. For information write Sheldon W. Samuels, New York State Air Pollution Control Board, 84 Holland Ave., Albany 8, N. Y.

July 16-21

Fourth International Conference on Medical Electronics and Fourteenth Annual Conference on Electrical Techniques in Medicine and Biology, Waldorf-Astoria Hotel, New York, N. Y. For information write Lewis Winner, convention and exhibit manager, 152 W. 42nd St., New York 36, N. Y.

July 31-August 4

International Congress of Biophysics, Stockholm, Sweden. For information write Dr. Bo Lindstrom, Dept. of Medical Physics, Karolinska Institutet, Stockholm 60, Sweden.

September 11-15

Conference and Exhibit Instrument Society of America, Sports Arena, Los Angeles, Calif. For information write John Witherspoon, 7107 Penfield Road, Canoga Park, Calif.

October 26-27

Electronic Techniques in Medicine and Biology, University of Nebraska, Omaha, Neb. For information write Harold G. Beenken, University of Nebraska, College of Medicine, 428 Dewey Ave., Omaha, Neb.

Educational Program For Career Research In Bio-Medical Engineering

Drexel Institute of Technology and The Presbyterian Hospital in Philadelphia offer co-ordinated programs in Bio-medical Engineering requiring up to two years of study for life and physical scientists, and one year for engineers to a Master of Science degree. The next student intake will be July, 1961. Cost of education is covered by Heart Institute and Markle Foundation Grants. For information write James W. Dow, M.D.; Head, Department of Bio-medical Engineering; Drexel Institute of Technology; 15 North 32nd St., Phila. 4, Pa.

Four Term Program for Group (1)— (Physical Scientists and Engineers)

SUMMER TERM D1
- Anatomy
- Medical Physics
- Mathematics
- Biophysics
- Biology
- Biology Laboratory

FALL TERM E
- Statistical Mathematics
- Medical Physics
- Electronics
- Biology
- Systems Engineering
- Thesis

WINTER TERM F
- Medical Physics
- Radioisotope Methodology Laboratory
- Systems Engineering
- Electronic Measurements
- Seminar
- Thesis

SPRING TERM G
- Data Handling
- Medical Instrumentation
- Seminar
- Thesis

Seven Term Program for Group (2)— (M. D.'s, Biologists, Graduates in Biology, Physiology, Medicine, etc.)

FALL TERM A
- Mathematics
- Circuits
- Measurements
- Instruments Laboratory

SPRING TERM C
- Mathematics
- Physics
- Electronics
- Electronics Laboratory

WINTER TERM B
- Mathematics
- Physics
- Circuits
- Electronics
- Instruments Laboratory M II

SUMMER TERM D 2
- Mathematics
- Physics
- Electronics
- Electronics Laboratory
- Medical Physics

NEW YORK ACADEMY OF SCIENCES SECTION OF BIOLOGICAL AND MEDICAL SCIENCES (2 E. 63 St., New York 21, N. Y.) held a conference on Plasma Proteins in Health and Disease on Jan. 12-13, 1961, at the Barbizon-Plaza Hotel, New York. On Dec. 30, 1960, the Section held a conference on Current Problems in Electrobiology.

A Sampling of

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1551-B SOUND-LEVEL METER
. . Meets all ASA specifications for sound-level meters. Measuring range is from 24 to 150 db above 0.0002 μbar with better than 1-db accuracy. Output for analyzers and recorders. Price, $415.

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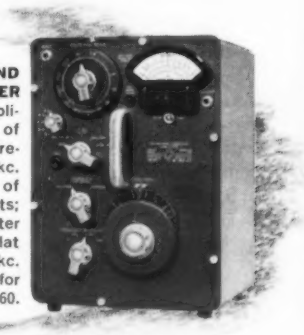
1531-A STROBOTAC® STROBOSCOPIC TACHOMETER
. . . Intense white-light electronic stroboscope useful for speed measurements, analyzing repetitive actions in apparent slow motion, photic stimulation, and flicker-fusion studies. Flashing range is 110 to 25,000 flashes per minute. Flash duration is 1 to 3 microseconds. Can be triggered externally. Price, $260.



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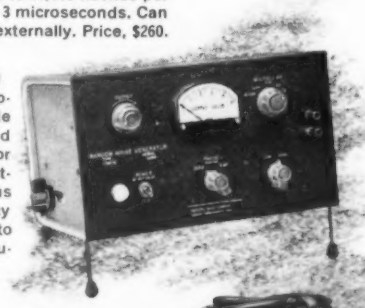

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. . . A source of wide-band noise approximating the statistical amplitude distribution of speech, music, and sounds that occur naturally. Useful for audiometric and pyschoacoustic testing as well as for simulating various masking effects. Three frequency ranges: 20c to 20 kc; 20c to 500 kc; 20c to 5Mc (3 db down at 5c). Built-in attenuator. Price, $295.

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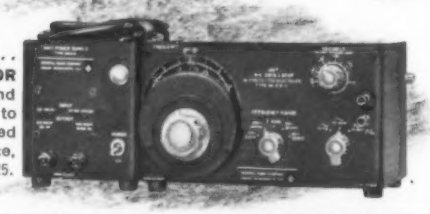
. . . A general-purpose sine- and square-wave oscillator with a 20c to 500 kc frequency range. Can be converted to sweep-frequency operation. Price, complete with power supply, $225.



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. . . Used with an oscillator to produce accurately known small a-c voltages . . . can be used to measure other small voltages by substitution methods. Voltage range, 0.5 μv to 1.0v open circuit. Basic accuracy is ±3% to 20 kc; useful up to 100 kc. Price, $155.

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2

PUBLISHED

MEDICAL ELECTRONICS NEWS

TRADEMARK

INSTRUMENTATION, ELECTRONIC AND ELECTROMECHANICAL DEVICES FOR USE IN BIO-MEDICAL RESEARCH, DIAGNOSIS AND THERAPY; RADIOLOGY; AIR POLLUTION, ETC.

PILOT ISSUE

FIRST REGULAR ISSUE TO BE PUBLISHED—

MARCH 1961

PUBLISHED QUARTERLY—COPYRIGHT 1961 BY INSTRUMENTS PUBLISHING CO., INC., 845 RIDGE AVENUE, PITTSBURGH 12, PENNA.

A PROMISING FIELD . . .

Few branches of instrumentation and electronics have more promise for the application of new devices and techniques than the comparatively recently opened field of biological and medical instrumentation and electronics. The application of better diagnostic tools will do much to relieve human suffering, conquer disease and circumvent operative procedures.

It is to fill this important objective that *Medical Electronics News* is designed. Each issue of this new publication will reach more than 25,000 doctors and technicians active in clinic and hospital research, medical and biological research institutes, medical schools, public health research laboratories, therapy, air pollution, etc. Each issue will report to these men the new instruments, new methods, and new developments in the field of instrumentation and electronics.

With 25,000 circulation, *Medical Electronics News* reaches more prospective users of these devices and components than any other publication. Its tabloid size permits efficient use of space—with editorial items flanked by advertising.

Potential Market

On determining potential markets and uses, we are very fortunate because the medical profession is completely documented.

Because physicians deal with birth, life, and death, it is easy to understand why the medical profession is so thoroughly documented. We know, for example, that there are about 182,000 active doctors of all ages, including staff physicians, plus an average interne population of 10,000, making a total of 192,000. We also know that of this total, 62,500 were general practitioners, 20,000 were surgeons, 14,700 specialized in internal medicine, 11,750 specialized in obstetrics, gynecology, or both, 4,100 were pediatricians, and so forth.

Not only do we know the numbers of physicians by specialties, but we also know where each one trained, the societies to which he belongs, his type of practice, his specialties of interest, and where he can be located. If he is a member of the Society for Nuclear Medicine, we need not look further to know that he is qualified to use radioactive materials and is a prospect for instruments that measure them.

Editorial Coverage

Medical Electronics News provides its readers:

1. Complete illustrated information on new instruments, electronic devices and components, laboratory apparatus and equipment, and services, edited for quick and easy reading.

2. An easy method for quickly obtaining manufacturers' cooperation when time and buying are important.

3. A digest of current manufacturers' literature on instrumentation and electronic devices which will find application in the medical field.

4. Each issue will have a report covering the trend in some phase of instrumentation and electronics.

5. Books of interest to the workers in the medical and biological fields will be reviewed.

6. Meetings of technical groups and societies of interest to this field will be listed.

7. Abstracts of papers on instrumentation and electronic devices of interest to the field will be included.

The distribution list of *Medical Electronics News*, will tap buying influences REACHED BY NO OTHER SINGLE PUBLICATION.

If you manufacture scientific instruments and apparatus purchased and used by individuals in biomedical laboratories of research and industry, *Medical Electronics News* offers you the largest available group of actual authenticated prospective buyers of medical and biological instruments and electronics devices.

Additional Advertisers will appear in the regular issue. Those herein were received before this "pilot" went to press. First regular issue goes to press March 5th. Be sure you are represented.

This cover space (between the red bars) belongs to the local equipment representatives who sponsor the distribution of *Medical Electronics News* throughout the United States. Each sponsor is given this space to display the products that he represents. In return, the sponsor pays the publisher for each imprinted copy sent to the doctors and technicians on his list of prospective buyers of bio-medical instrumentation equipment. Each sponsor sees that every buying influence in his area is covered, and that every prospective buyer and user receives a personal copy of the magazine.

BRIEFS

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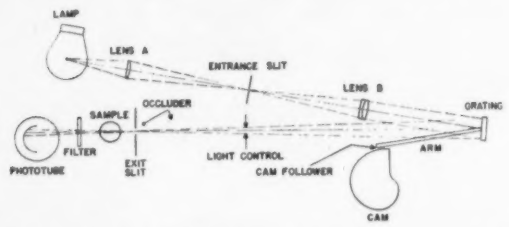
Spectronic Analyzers

Colorimetry and Spectrophotometry will be taken care of by this ultra-modern instrument. In clinical and pathological laboratories; industrial and food laboratories; colleges and universities; water and stream pollution control projects; public health and general biochemical laboratories . . . The Bausch & Lomb Certified-Precision Diffraction Grating, 600 grooves per mm, eliminates filters throughout the 375-650 mμ range, and to 950 mμ with a quick change



of phototube and supplementary infra-red transmitting filter . . . In *Colorimetry*, quick, easy readings in optical density or percent transmittance are taken direct from the scale. Straighter, steeper plots are obtained, where Beer's law applies, because of the narrow band pass and absence of stray light . . . In *Spectrophotometry*, the certified-precision diffraction grating pinpoints absorption measurements between quickly selected settings of the wavelength selector knob . . . You can run assays for Serum Glutamic-Oxalacetic Transaminase in one-sixth the time of other methods —if you can make photometric readings at 340 mμ. (Karmen, A . . *J. Clin. Invest* 34, 131-33; 1955.) That means the only colorimeter than can do it is a B&L Spectronic 20 . . . (*From new 8-page Catalog D-266. Bausch & Lomb Optical Co., 60245 St. Paul St., Rochester 2, N. Y.*)

FOR THIS LITERATURE CIRCLE 1 ON READER-SERVICE CARD

Cardiac Resuscitation System

New Cardiac Resuscitation System combines two new transistorized instruments: a small, portable, self-powered cardiac pacer and a bedside monitoring unit that will respond to indications of heart arrest by switching the pacer into operation and by signalling an alert via radio. The cardiac pacer is essentially a

compact source of periodic electrical stimuli whose pulse rate and amplitude are adjustable over wide ranges. Contains its own source of electrical energy in the form of mercury batteries. The cardiac monitor constantly monitors the patient's heartbeat and, in the case of heart arrest, causes the pacer to begin stimulation of the patient's heart at a preset rate and amplitude. An integral radio transmitter broadcasts a coded alarm signal in case of emergency. Signal can be received at distances above 2½ miles by a receiver about as large as a package of cigarettes. . . . (*Westinghouse Electric Corp.'s X-ray and Industrial Electronics Div.*, 2517 *Wilkens Ave., Baltimore* 3, *Md.*)

FOR THIS LITERATURE CIRCLE 2 ON READER-SERVICE CARD

MINNEAPOLIS-HONEYWELL is the developer of a space-cabin simulator in which two Air Force volunteers at the School of Aviation Medicine at Brooks Air Force Base last fall lived for thirty days in space-travel-like isolation with all facilities of a self-contained unit for breathing, eating, drinking, and personal hygiene. The atmosphere control system is based on chemical absorption and catalytic filters, temperature and humidity are controlled, and solid wastes are dehydrated and burned, with disposal of the gases produced by an afterburner. The remains are a small amount of fine ash. A vacuum distillation system affords use and re-use of waste water.

MEDICAL ELECTRONICS NEWS

Instrumentation, Electronic and Electromechanical Devices for use in Bio-Medical Research; Diagnosis and Therapy; Radiology; Air Pollution, etc.

VOL. 1 MARCH, 1961 PILOT

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EDITORIAL FUNCTION & SCOPE

Medical Electronics News will provide a means whereby the results and techniques of the instrumentation and electronics specialties can be made more generally available.

As part of its editorial scope, each issue will report the new instruments, new techniques, and new developments in the field of instrumentation and electronics.

FIELD SERVED

Each issue will reach over 25,000 doctors and technicians active in clinic and hospital research, medical and biological research institutes, medical schools, public health research laboratories, therapy, air pollution, etc.

This, in effect, means virtual blanket coverage of the entire medical and biological research market.

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All standard size advertising is accepted. Rates are based on the total amount of space used in 12 months from date of first insertion.

Advertising space rates below are based on standard page size (7" x 10"). Special rates for extra size advertisements, upon request.

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3 PAGES used within 1 year . . . $860.00 per page
4 PAGES used within 1 year . . . $855.00 per page
6 PAGES used within 1 year . . . $850.00 per page
8 PAGES used within 1 year . . . $840.00 per page
12 PAGES used within 1 year . . . $830.00 per page

Equivalent space used in Instruments and Control Systems, Instrument & Apparatus News, and Military Systems Design earn 10% discount in each publication involved.

ISSUANCE AND CLOSING DATES

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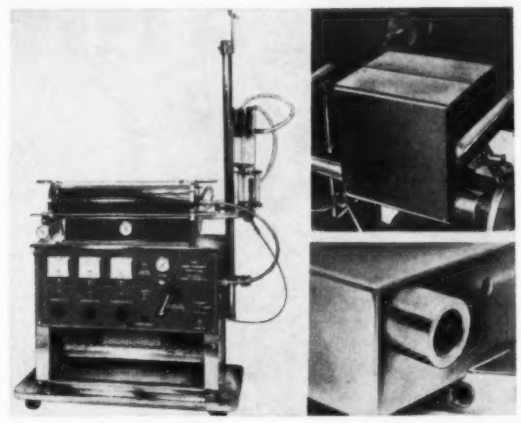
The publication is circulated to customer-prospects by instrument manufacturers' agents, laboratory apparatus distributors, electronic component distributors. The lists are made up of the customer prospects of these agents and distributors. Available to others at the subscription price of $6.00 per year.

Other Publications of the Instruments Publishing Co.
INSTRUMENTS & CONTROL SYSTEMS
INSTRUMENT & APPARATUS NEWS
MILITARY SYSTEMS DESIGN

MEDICAL ELECTRONICS NEWS

Safer Heart-Lung Machine

HINGHAM, MASS.—Conventional welding techniques for joining stainless-steel components in artificial heart-lung machines are unsatisfactory because of ever present microscopic cracks in the joint area. This necessitated excessive grinding and polishing to achieve the almost perfect finish required on this equipment.



High Vacuum Equipment Corp. of Hingham, Mass., through its subsidiary Kinetics Corp., and the Mark Co., a division of Image Transfer Inc., producers of the machine, have joined forces to apply a new brazing technique. Evolved by Kinetics Corp., this technique uses a filler metal, primarily composed of nickel, which is preplaced in the joint area before brazing in a vacuum furnace at temperatures of 1800 to 2200°F. Skillful polishing of the finished product produces a homogenous appearance, inasmuch as the brazing metal approximates the color of stainless steel. This technique eliminates all possibilities of the presence of toxic constituents which can creep in by low-temperature braze filler metals and fluxes.

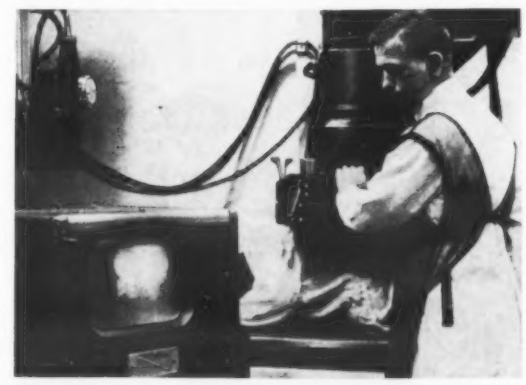
Cells Return from Space

BROOKS AIR FORCE BASE, TEXAS.—Aboard the Discoverer 17 satellite, launched November 12, 1960 from Vandenberg Air Force Base, were living human cells and other biological and measuring specimens, contained in a three-pound aluminum capsule. They had been included as part of a series of experiments being conducted by the School of Aviation Medicine in joint participation with the Air Force Ballistic Missile Division and Lockheed Missles and Space Division. The recoverable portion of the satellite was caught in midair near Hawaii.

The school's Department of Radiological Biology reports that radiation dosimeters indicated that the specimens had not received a lethal dose of radiation, despite the fact that an unscheduled incident had greatly increased "normal" radiation to be encountered in space: Just before launching the satellite, a massive solar flare began which continued for the first 13 hours of the 50-hour orbit of the satellite.

X-Rays and TV Join Forces

NEW YORK, N. Y.—At a luncheon of the American College of Radiology, Dr. Russell H. Morgan, professor of radiology at Johns Hopkins University, demonstrated an image intensification system which allows viewing of x-ray pictures in daylight on a screen, while the patient is being examined.



In the system, x-rays are converted into greatly intensified light rays before striking the fluoroscopic screen. This procedure does not only take such examinations out of the darkened room with its inconveniences and time delay for the eye to accommodate to the darkness, but affords also the possibility for viewing by a large audience and even the patient himself. Normal x-ray dosages are applied, as intensification from x-rays to light rays on TV system coupled with electronic image tubes is 50,000 times.

Physical Data from Space

NORTH HOLLYWOOD, CALIF.—Electronic medical data will be radioed back to earth when America's first astronaut will orbit the globe in his Project Mercury capsule.

The Bendix Corporation's Bendix-Pacific division (11600 Sherman Way, North Hollywood, Calif.) is equipping the special ground stations, being set up in all parts of the world, with the telemetering systems that will receive data on the spaceman's pulse, temperature, respiration, physical reactions, and oxygen consumption. These measurements will constitute only part of the 90 different variables that will be transmitted to earth, reporting on the vehicle and its passenger's functioning.

As each station receives the information, it will be transmitted to a central computing installation in Greenbelt, Md. where it will be displayed and recorded for immediate and future observations.

Ear Protection

PITTSBURGH, PA.—At NASA's Flight Research Center, Edwards, Calif., as much attention is now paid to ear protection of the ground crew, as was paid in the early days of jet aircraft operation to protect the airborne crew.

Heat-set type ear protectors manufactured by Mine Safety Appliances Co. (201 N. Braddock St., Pittsburgh 8, Pa.) have proved to lessen the effects of long noise exposures considerably. Ground crews, during their daily 8-hour shift, are often exposed to noise levels ranging above 100 decibels. Aircraft maintenance crews have to endure noise levels reaching 130 plus decibels. Psychological and physiological effects of such exposures have been studied and remedial measures have been suggested.

Medical Electronics

PHILADELPHIA, PA.—The Division of Research of Lankenau Hospital, in cooperation with Brown Instruments Division of Minneapolis-Honeywell, recently demonstrated application of an automatic data handling system in environmental studies.

The hospital division, under the direction of Dr. Kaare Rodahl, is conducting research to determine the effect of varying levels of protein diet upon individual performance capacity. The subject's diets, which may be 1500 or 3000 calories per day, contain either 70 grams of protein or none at all. In the research program, which focuses attention to acclimatization to cold, the subjects are exposed in a climatic chamber for 10 days to a constant temperature of 44°F, wearing only shoes, socks, and shorts. At night they sleep on a mattress-less cot, covered only with a GI blanket.

Their temperatures are under constant automatic surveillance. Strapped to various locations on their bodies are sensitive thermocouples which feed their signals through a digital potentiometer into a Brown Analog-Digital Recorder-Transcriber. It prints out the digitized readings with resolution of 1 in 4000 by electric typewriter, or codes the results on punched cards or tape.

Other tests include recording of blood pressure and heart rates after the subject exercises on a bicycle or treadmill to near-exhaustion; use of a paramagnetic analyzer to determine maximum oxygen consumption; of an infrared analyzer to determine maximum oxygen consumption; of an infrared analyzer to measure expelled carbon dioxide; and blood-sample analysis.

AEC Awards Contract

MT. VERNON, N. Y.—The Atomic Energy Commission has acknowledged Consumers Union's nonprofit research efforts in tracking down strontium-90 and other radioactive elements in typical daily diets, by awarding CU a $20,000 contract.

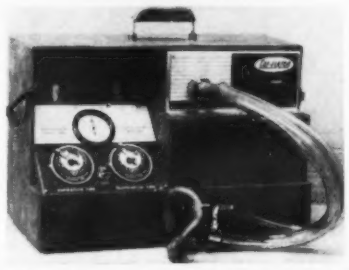
Samples of typical daily diets will be collected and packaged in 25 cities all over the country, and shipped to CU's consultant radio-chemistry labs. In addition to strontium-90, seven other radioactive elements will be included in the study. Special attention is being paid to the great variety of teen-age food and snacks, and the samples will include also samples of water consumed.

BLONDER-TONGUE FOUNDATION, 9 Alling St., Newark, N. J., offers an internship at the Institute for Advancement of Medical Communications for the purpose of studying the latest techniques of closed-circuit TV.

PRODUCTS

FOR MORE DATA, CIRCLE PERTINENT NUMBER ON CARD.

COFFLATOR



New improved Model 81 of the Cofflator stimulates the coughing function in those who have lost their cough reflex or who through paralysis are unable to rid themselves of secretions and mucus. Recommended for atelectasis, bronchial asthma, bronchiectasis, respiratory interruption, emphysema, poliomyelitis and cases of paralysis from brain stem damage. —*Shampaine Industries, Inc., O.E.M. Div., East Norwalk, Conn.*

CIRCLE 3 ON READER-SERVICE CARD

NEGATIVE ION GENERATOR

New portable Ionaire generates more than a billion negative ions/sec in operation, by weak beta emission from tritium sealed in titanium foil. Medical researchers have shown that negative ions, in sufficient quantity, can bring about improved ciliary action in the trachea, reduction in nose and throat congestion, and relief from breathing difficulties.—*United States Radium Corp., Morristown, N. J.*

CIRCLE 4 ON READER-SERVICE CARD

PNEUMATIC TOURNIQUET

New Montgomery Tourniquet Cuff uses specially developed Regulator which provides the constant pressure required for surgery situations on an extremity as a means of controlling blood circulation. Permits pressure relief without the need for bleeding off total system pressure.—*Robertshaw-Fulton Controls Co., 911 East Broad St., Richmond 19, Va.*

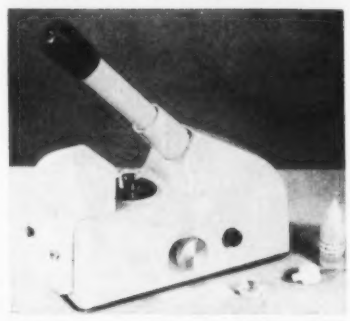
CIRCLE 5 ON READER-SERVICE CARD

PHOTRONREFLECTOMETER

New research project for the identification of pathological conditions through analysis of serum protein uses a photronreflectometer where specimens are inserted into the cell holder to measure the extent of diffusion between serum cerefully layered above a rabbit antiserum-agar mixture in a glass ampule.—*American Instrument Co., Inc., 8030 Georgia Ave., Silver Spring, Md.*

CIRCLE 7 ON READER-SERVICE CARD

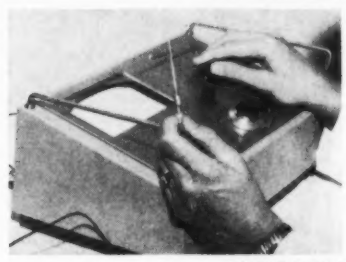
SERUM PROTEIN METER



New Serum Protein Meter Model 35-45-87-01 provides accurate three-step protein analyses in as little as one-tenth the time required by chemical methods. No temperature controls are required, other than equal temperatures for both sample and distilled water. Readings are referred to the index of refraction of water. Eyepiece reticle contains two scales; one providing readings in serum protein directly to 0.1 gram, the other, reading in refractive index difference.—*Bausch & Lomb Inc., 90715 Bausch St., Rochester 2, N. Y.*

CIRCLE 8 ON READER-SERVICE CARD

BLOOD OXYGEN ANALYZER



New Physiological Gas Analyzer has a platinum-tipped electrode, 0.0005" dia which can be inserted into blood vessels, arteries, other body fluid reservoirs, even the brain itself. In place, the electrode produces direct oxygen readings, in contrast to standard techniques which require withdrawal of samples for oxygen measurement.—*Beckman Instruments, Inc., 1117 California Ave., Palo Alto, Calif.*

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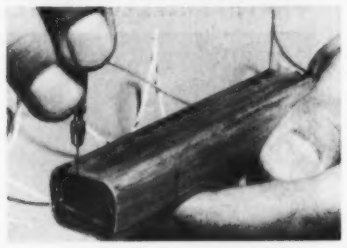

New Radiation Detector measures amount of radiation man will meet in space. Packaged with signal amplification units in small, cigar-size cylinders, detector is essentially a thin slice of silicon. Telemeter system transmits the signals to receiving stations on earth as the vehicle moves through space.—*Hughes Aircraft Co., Florence Ave., Teale St., Culver City, Calif.*

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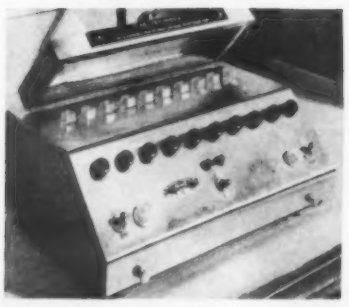

New Rate Recording Photometer for automatic read-out of Protein Bound Iodine Determinations using the ceric-arsenite system, records the rate of change of transmittance which indicates the iodine concentration in ten different samples (knowns and unknowns) simultaneously.—*Microchemical Specialties Co., Berkeley 10, Calif.*

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STEREOTAXIC INSTRUMENTS. 4-page Bulletin 5 illustrates and describes Model 4-C which permits research on small dogs, in addition to its regular uses on cats, monkeys and rats.—H. Neuman & Co., 8132 N. Lawndale Ave., Skokie, Ill.

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SURGICAL SCINTILLATION DETECTORS. 4-page DS8-1 Brochure describes in detail the new DS8-1 Scintillation Detector Set.—Nuclear-Chicago Corp., 359 East Howard Ave., Des Plaines, Ill.

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LABELED COMPOUNDS. 12-page Catalog 587 contains stock list of components labeled with radioactive and non-radioactive nuclides.—Nuclear Corp. of America, Box 688, 170 West Providence, Burbank, Calif.

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BIOLOGICAL PRODUCTS. 72-page booklet describes Vaccines, Toxoids, Immunogens, Antitoxins, and Diagnostic Agents.—Parke, Davis & Co., Detroit 32, Mich.

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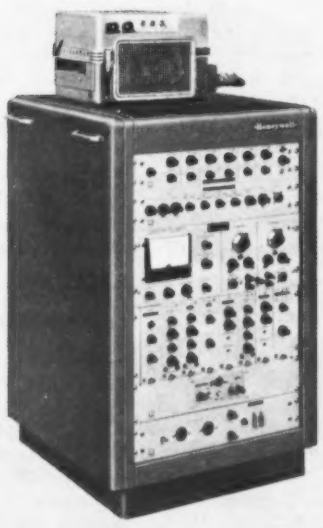

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ANALOG TAPE RECORDER. 4-page bulletin illustrates and describes features of Model M102 precision system used in electrocardiography, electroencephalography, etc.—Mnemotron Corp., One N. Main St., Spring Valley, N. Y.

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DEODORIZERS. 2-page Bulletin A-60 describes construction and application of electrostatic deodorizer for use in hospitals and laboratories.—Morris Deodorizers, Inc., 2819 Broadway NE, Knoxville 17, Tenn.

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THROMBOGRAPH. 8-page issue of the "Photocord," No. 2, describes several electronic instruments for the laboratory, including the Varicord, a bench-type recorder; a densitometer for checking performance of microfilm equipment; the Thrombograph for determination of clotting time; a reflection meter, etc.—Photovolt Corp., 95 Madison Ave., New York 16, N. Y.

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LABWARE. 40-page edition of the monthly S/P Review provides a resume of major equipment and supplies presented in past issues. Items featured include balances, centrifuges, recorders, microscopes, spectrophotometers, pH meters, glassware, membrane filters, plastic labware, etc.—Scientific Products, 1210 Leon Place, Evanston, Ill.

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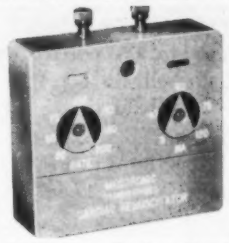

New Medtronic Pocket Cardiac Resuscitator stimulates ventricular function in cardiac arrests due to drug and anesthesia reactions and those that occur spontaneously as in Stokes-Adams syndrome. Employs a transistorized circuit.—*Medtronic, Inc., 818 19th Avenue N.E., Minneapolis 18, Minn.*

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New Eye Movement Camera consists of an optical system that transmits corneal reflection, plus what the observer sees, to a motor-driven 8-mm movie camera. Superimposed on the picture is a white dot showing the eyes' exact center of attention.—*Westgate Laboratory, Inc., P.O. 63, Yellow Springs, Ohio.*

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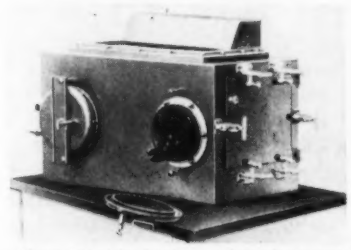

New Double-Incineration Accessory for the Isolator/Lab keeps the interior, once it's been sterilized, germ-free. Any organisms in the air *entering* the sealed unit are removed by a high-efficiency filter system or killed by incineration at 750°F. Any organisms in the air *exhausted* from the Isolator/Lab are destroyed and removed by the same process.—*Fisher Scientific Co., 717 Forbes Ave., Pittsburgh 19, Pa.*

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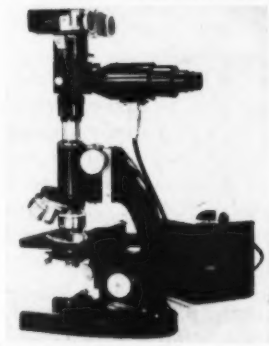
UV PHOTO-MICROSCOPE



Ultraviolet photo microscope Model 31-51-47-01 permits visual focusing by use of the RCA ultrascope tube for examination of specimens under ultraviolet light, such as tissue cell screening, bone marrow observation and the determination of hemoglobin in liver.—*Bausch & Lomb Inc., 90715 Bausch St., Rochester 2, N. Y.*

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CIRCLE 33 ON READER-SERVICE CARD

medical instrumentation

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BRIEFS

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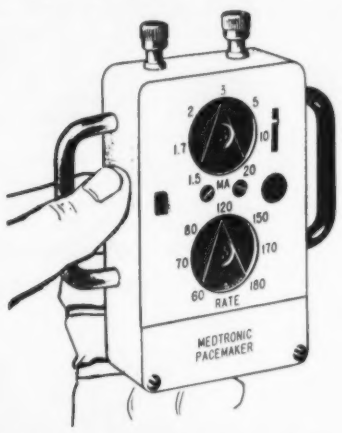


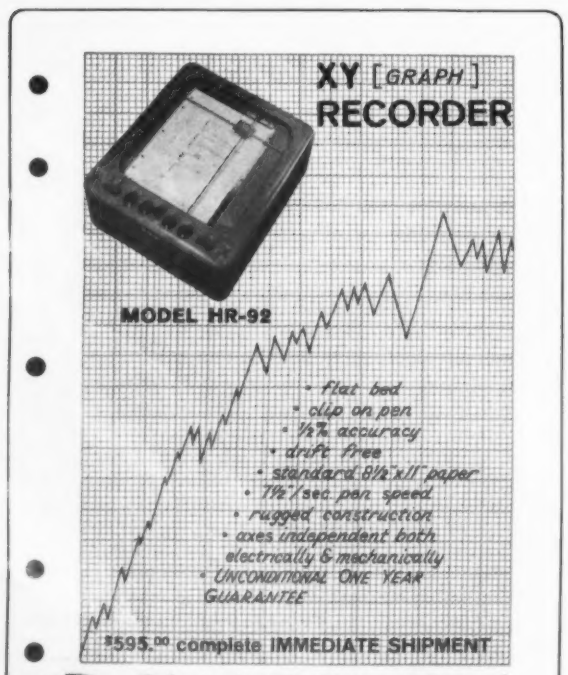
The Pacemaker is designed for internal applications with at least one wire attached directly to the myocardium for temporary stimulation or with a bipolar patch for prolonged stimulation . . . Neon flasher indicates function of Pacemaker. It may be disconnected by interchanging the screws on the front panel to extend the life of the Pacemaker battery, if desired . . . (*From new 36-page booklet "Medical Engineering"—Medtronic Inc., 818 Nineteenth Ave. N.E., Minneapolis 18, Minn.*)

FOR THIS LITERATURE CIRCLE 35 ON READER-SERVICE CARD

Sequential Air Sampler

The Gelman Sequential Sampler fills the need for a small portable instrument which will automatically collect air samples for subsequent analysis of contamination. It can be used for either gas determination or dust counting or both of these simultaneously. Up to twelve midget impingers for dust or gas collection are placed in the rack provided inside the case. Air is drawn through each of these collectors in turn at a predetermined rate for the desired time periods. Each impinger may be filled with a different gas detection reagent so that complete air analysis can be made . . . A twelve position valve, connected to a vacuum source through an adjustable flowmeter, provides a separate inlet for each sample collector. An adjustable timer automatically advances the valve according to the selected program so that up to twelve samples can be taken without operator attention. At the end of the sampling series the Sequential Sampler turns itself off and awaits sample attention. . . . (*From new 44-page Publication "Dust Topics," Vol. 1, No. 2, Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.*)

FOR THIS LITERATURE CIRCLE 36 ON READER-SERVICE CARD



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CIRCLE 59 ON READER-SERVICE CARD

AN AUTOMATIC HE

This heart-lung-anesthesia machine utilizes the dynamics of the patient in a feedback system to maintain as nearly as possible a homeostatic environment. It achieves this by utilizing a pump with independent rate and stroke volume controls, both of which are automatically varied according to the physiological requirements of the patient as measured by various controlling devices. The pH of the blood and its oyxgen tension are controlled at exact values while the anesthesia level of the patient is maintained closely by use of an anesthesia machine that utilizes the cortical output to determine depth of anesthesia and control its administration accordingly.

A heart-lung machine should be completely automatic so that a patient could be maintained indefinitely by the machine. Practical limits must be set as to what the machine should do, and the anesthetist and surgeon must be informed when the parameters have been exceeded so that they may step in with appropriate action to bring the patient's vital processes back within the desired limits.

Oxygenation of Blood

Two techniques are used at present for oxygenating blood. One is to supply an artificial lung; the other is to make a complicated connection to and from a pump and to and from a lobe of the patient's lung. The difficulty of making connections in the second case and the inability to monitor conditions in the lung, and certainly to control them, makes this method inferior to the artificial lung.

The artificial lung withdraws blood from the superior and inferior vena cavae and myocardium return, and returns blood via the subclavian artery to the corporeal circuit.

Cleland[1] describes briefly a technique whereby he allows blood to pass over the surface of many plates to give a large surface area to the blood to permit adequate oxygenation. Clark et al[2] oxygenated blood by the simple means of bubbling O_2 through a blood reservoir. They showed this could saturate the plasma and blood cells to a pressure of 600-700 mm at high blood flow rates. They did some development work on using a polarograph to measure directly the O_2 tension in tissues as well as the blood stream. To prevent interference of the red blood cells they covered the tip of the Pt electrode with cellophane. By this technique they have been able to get reproducible results on O_2 tension both in the blood and tissues.

The normal oxygen tension of blood is 100 mm, at which pressure the red blood cells are saturated but the plasma is not. To maintain this O_2 pressure, rather than allowing it to rise to 600 or 700 mm, they put a venous blood bypass around the oxygenator, and placed the polarograph electrodes downstream from the junction of the venous and oxygenated blood. Using the polarographic output to control a valve in the bypass, venous and oxygenated blood are mixed to maintain a partial pressure of O_2 (pO_2) of 100 mm.

The Gibbon machine[3] used by the Mayo Clinic has a series of screens through which the blood passes to expose a large surface area to the oxygen. They maintain a constant flow rate of 10 liters/min of O_2 without any provision for controlling pO_2 of the output blood (except to assure complete saturation). They, however, do make a useful contribution toward automation by automatically controlling the blood's pH at 7.43 to 7.45 by using a pH meter to control a valve to admit CO_2 to the oxygenator to maintain the pH.

Pumping the Blood

The pump is of extreme importance in the system and there has been a wide variety of solutions attempted. Most of these use a tube of platic that is squeezed by some mechanism to force the blood out.*

*Cleland[1] describes a tube squeezed between two plates that are in turn forced together by eccentric cams on a shaft; the blood is kept moving in the proper direction by cams on either end of the same shaft that occlude the tube at the proper end and act as valves. The Gibbon's pump[3] is made up of two rollers mounted 180° apart and rotated through a 360° path to occlude the tubing containing the blood; the tubing is mounted concentrically with the rollers' path and the rotation of the rollers through their path forces blood through the tubing. Another method is used by Dodrill[4] whose pump works with finger cots inside of glass tubes by alternately expanding and deflating them to force blood between the tubes and cots.

One of the most versatile pieces of equipment is described by Rose et al[5], who have developed a diaphragm pump that can be used to give an extremely wide range of independently controlled volumes and rates. In this instrument the stroke volume and rate are entirely independent and the stroke volume can exceed the physiological need. The output volume may be maintained constant despite changes in peripheral resistance, and normal pulsatile pressures are maintained.

They employ a diaphragm pump that is driven by a mechanico-hydraulic drive that is used to vary stroke volume and rate independently. The output valve is spring loaded to prevent leaking and consequent output volume pressure variations. The diaphragm is Kel F. Most surfaces are polished methacrylate and the remainder of the surfaces exposed to the blood are stainless steel.

The evidence indicates that all the pumps described are about equally traumatic to the blood cells flowing through, giving equivalent hemolysis rates.

The Gibbon machine[3] is the most completely instrumented heart-lung machine to date. It uses a controlled vacuum to withdraw blood from the vena cavae and the myocardium return. By appropriate measures blood is defoamed and enters a reservoir that is maintained at a constant level. Blood is pumped from here to the oxygenator and thence to another pump supplying the systemic

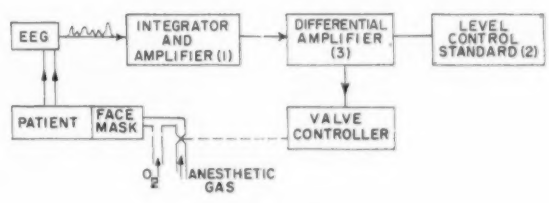

Fig. 1. Anesthesia machine.

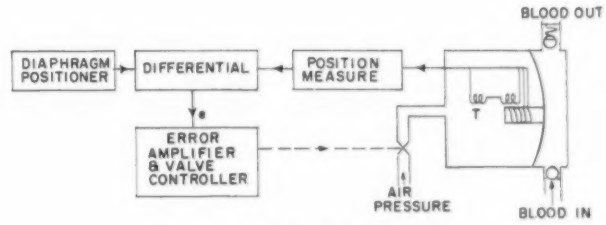

Fig. 2. Control of heart pump.

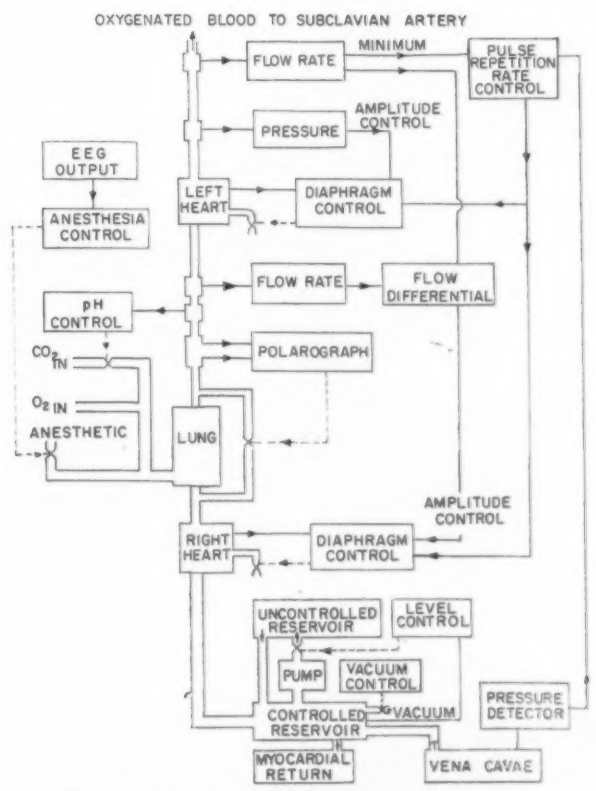

Fig. 3. Proposed heart-lung-anesthesia machine.

HEART-LUNG MACHINE

ROBERT GENTRY, M.D.
Knoxville,
Tennessee

circuit. Some of the blood is recirculated in the reservoir and, if the blood level in the reservoir increases, there is less recirculation and more is pumped to the systemic circuit. Contrarily, when the reservoir level drops, more blood is recirculated and less is pumped into the systemic circuit.

The author finds this one of the main objections to this machine. It does not seem logical that the blood level in the reservoir is of primary importance. Rather, if less blood is being returned by the systemic circulation (for example, if there is vasodilation so that the reservoir level drops) it seems logical to send more blood, not less, into the corporeal circuit.

The developers find it convenient to monitor the vena cavae pressures and the arterial O_2 saturation (by means of an oximeter that measures the 470-mu transmission to assure complete saturation). The arterial outflow pressure, the artery pump output and systolic B/p, the venous vacuum and controlled pH are measured constantly. The EKG and rectal temperature of the patient are followed continuously.

Anesthesia Control

One additional point seemingly not considered by builders of heart-lung machines is that with it should be incorporated the automatic administration of anesthesia. The literature [6, 7, 8, 9] contains an interesting account of the evolution of automatic anesthesia machines since 1950.

In essence, the cortical output of the brain is inversely proportional to the level of anesthesia. By amplifying the electroencephalographic output of an anesthetized patient and electronically integrating it over a short period of time, it is possible to utilize the signal developed to drive a motor that will continuously reset the opening of a valve administering anesthetic agent to the patent. As the patient becomes more deeply anesthetized, his cortical output drops, causing the motor to close the valve passing anesthetic; as he lightens, his output increases, causing the motor to open the valve to admit a greater amount.

Fig. 1 shows a block diagram of how the machine works. The EEG output is amplified and integrated in (1); the level of this signal (above 0 volts) is compared with a standard signal from the anesthesia level control (2). The differential amplifier (3) compares these two signals and amplifies the difference. If the integrator output (1) is greater than the standard (2), the patient is too light and the valve controller opens the valve to pass more anesthetic. If the standard's output is the greater, then the patient is too deep and the valve is closed a little more. By using great amplification in the differential amplifier, any desired exactness of anesthesia level can be maintained. By varying the output of the level control standard (2), any level of anesthesia can be achieved. By such a system it is possible to automate anesthesia of the patient.

Heart-Lung Machine

It is now seen that many heart-lung instruments have been designed with greater or lesser degrees of automation. The author wishes to outline some of the ways in which a heart-lung machine can be more completely automated.

Inasmuch as all pumps considered cause about the same rate of hemolysis, there is freedom to choose whichever pump appears to offer the greatest assets. The diaphragm pump can be developed to an extremely versatile instrument by a few alterations. The most important is to replace the mechanical-hydraulic drive with a pneumatic one. In other words, we shall use air pressure to drive the diaphragm. By a simple alteration of air pressure to the driving side of the diaphragm, the diaphragm will move in and out. However, it is necessary to control the diaphragm's movement constantly in order to insure an exact stroke.

Fig. 2 shows how control can be achieved relatively simply by the use of an electro-pneumatic technique employing a linear differential transformer (T) with its electronic circuitry. By attaching the moving coil rigidly to the center of the diaphragm and the stationary coils to a non-moving part, the exact movement of the diaphragm—its precise position and acceleration at any given instant—can be measured electronically. By taking the difference of the actual position of the diaphragm (as measured) from the desired position (as determined by the "position control") the error (e) can be detected. The error signal is amplified and used to control the valve opening to increase or decrease the air pressure applied to the driving side of the diaphragm. When the valve is opened the diaphragm is driven farther in; as it closes the diaphragm moves back toward its neutral position.

This technique permits any desired rate of action, completely independent of stroke amplitude. In addition, nonsinusoidal waveforms (such as sawtooth or square waves) could be produced as easily as sine waves. By this method a heart pump can be developed that is completely automated. However, no provision has been described that will adapt its action to that required by the dynamics of the patient.

Fig. 3 shows a heart-lung-anesthesia machine that is automated to satisfy the physiological needs of the patient. At the output of the left-heart analog, the system pressure is continuously measured by the pressure detector. If, for example, the blood pressure starts to fall, an error signal is fed into the positioner control which increases its gain, causing the diaphragm of the pump to work through a greater amplitude, increasing the output pressure (and volume) of the pump. A pressure increase has the opposite effect.

In addition, there is a *flow rate* meter to detect the flow of blood to the system. If this falls below a certain amount (as it might if there was a marked increase in peripheral resistance causing increased pressure and consequent small excursion of the pump's diaphragm) it sends a signal to the pulse repetition rate (PRR) control and causes an increase in frequency of pulses fed into the diaphragm position control.

The right-heart analog, though designed on the same principle as the left heart, does not require the same controls. Its diaphragm positioner is controlled by the same pulse rate, but a flow rate measure should be used at the inlet to the left heart, and the difference between this flow and the output flow rate of the left heart is used to control the amplitude of the output of the right-heart diaphragm positioner in order to maintain identical outputs of both right and left heart. In this way variations in the individual pumps are unimportant as long as the two flow rate meters are calibrated together.

The pulse repetition rate control (PRR) should be set at a nominal value. Its rate would be changed as mentioned by the output flow rate dropping below a certain minimum. In addition, a pressure detector mounted in the vena cavae would exert a controlling influence. If the pressure in the cavae increases, it would cause an increase in the PRR output frequency to speed up the circulation and reduce the pressure as it does in the Bainbridge reflex. Decreased pressure would have the opposite effect.

Using a controlled vacuum for returning blood from the vena cavea and the myocardium into a reservoir with a controlled blood level (as used in the Gibbon machine[3]) would probably be the most satisfactory way to maintain constant conditions for the machine, though it seems that in addition there should be an uncontrolled reservoir that is replenished manually when necessary. The level-controlled reservoir should be in constant circulation with the uncontrolled reservoir (for example, by placing the uncontrolled above the controlled and pumping blood into the uncontrolled with a pump whose output can be controlled by means of an occluding valve and letting the blood drip back in). The error of the level in the controlled reservoir should be integrated over a short period of time, say one minute, so that instantaneous fluctuations do not affect the occluding control. However, if the patient utilizes more blood, the level in the controlled reservoir will drop over a period of time and the recirculating pump will circulate less blood back into the uncontrolled reservoir so that the controller maintains a constant level despite the organism's requirements for more blood. If the level in the uncontrolled reservoir dropped dangerously low, a buzzer could warn that more blood was needed. Other fluids would be administered through a different inlet.

Again, turning to the Gibbon machine,[3] the lung analog has been well developed for the purpose of oxygenating the blood and controlling the pH and readily meets the other requirements for automating the instrument. A polarograph, used to determine the pO_2 and control it at 100 mm by bypassing some venous blood around the lung, would be used instead of the oximeter in order to maintain exact control of the oxygen saturation of the blood.

In addition, gas anesthesia would be administered to the lung by controlling it with the automatic techniques described. Intravenous anesthesia could be automatically injected at any point in the system if it is preferred.

Except for the driving control mechanism of the pump, the various unit parts such as pressure detectors, flowmeters, pH meters and control valves are commercially available or have been developed.

TERMINOLOGY

pO_2—partial pressure of oxygen (as compared to N_2, etc.), all of which make the total pressure; that portion of total pressure contributed by O_2 pressure.

O_2 TENSION—really partial pressure, but sense is modified (slightly) since there are enzyme systems, etc. that influence how easily the O_2 comes out of solution or chemical combination with the blood and plasma; it is the same as pO_2.

HEMOLYSIS—break down of blood cells (through trauma here, though not limited to this). It may be natural such as happens to donor cells following a transfusion, chemical break down, etc.

HEMOSTATIC—to stop blood—normally refers to the prevention of bleeding through a wound.

HOMEOSTATIC—uniformity or stability in normal body states (internal environment or fluid matrix) of the organism. Maintaining a constant state for the body.

470-MU TRANSMISSION—this wavelength of light readily distinguishes oxygenated and unoxygenated blood. The cyan color of a cyanotic person is due to the blueness caused by this wavelength.

B/p—common medical abbreviation for blood pressure.

TRAUMATIC—caused by injury.

SYSTEMIC—pertaining to or affecting the body as a whole.

VASODILATION—a dilated or relaxed state of a (blood) vessel.

VENA CAVA—the two large veins which return blood to the heart (superior v.c. from the head, neck, chest; inferior v.c. from lower body).

MYOCARDIAL—pertaining to the myocardium (the heart muscle).

SUBCLAVIAN ARTERY—the artery under the clavicle (supplies blood to arm).

CORTICAL—pertaining to the cortex, or the outer layer of an organ (in this case the brain).

pH—hydrogen-ion content; measure of acidity or alkalinity of a fluid.

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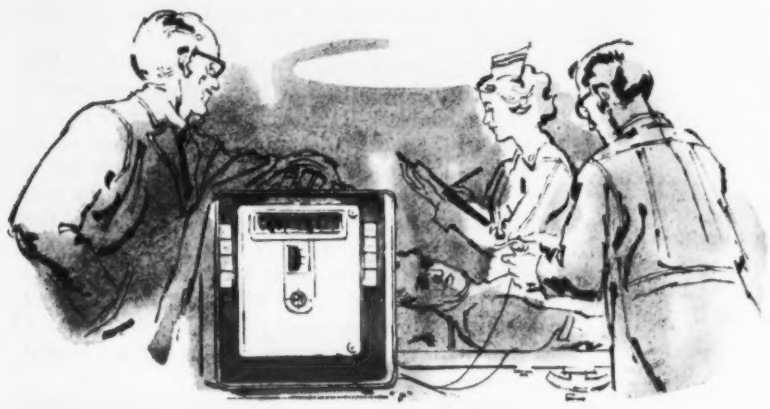

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